W O R L D W I D E
wwPDB
PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

May 22, 2023 – 07:18 PM EDT

PDB ID	:	3NHR
Title	:	X-ray Crystallographic Structure Activity Relationship (SAR) of Casimiroin and its Analogs Bound to Human Quinone Reductase 2
Authors	:	Sturdy, M.
Deposited on	:	2010-06-14
Resolution	:	1.80 Å(reported)

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

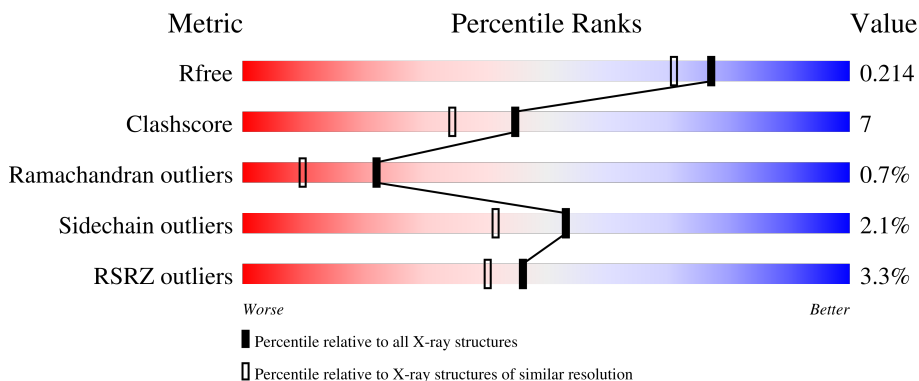|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.33
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.33

1 Overall quality at a glance ⓘ

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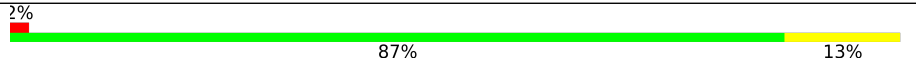*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.80 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	Percentile Ranks	Value
Rfree		0.214
Clashscore		7
Ramachandran outliers		0.7%
Sidechain outliers		2.1%
RSRZ outliers		3.3%

Worse — *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	5950 (1.80-1.80)
Clashscore	141614	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)
RSRZ outliers	127900	5850 (1.80-1.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	230	4% / 80% / 18% / ·
1	B	230	2% / 87% / 13%

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
4	RZW	B	233	-	-	X	-

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 4214 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 Ribosyldihydronicotinamide dehydrogenase [quinone].

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	229	Total	C	N	O	S	0	0	0
			1819	1171	303	337	8			
1	B	230	Total	C	N	O	S	0	1	0
			1833	1179	305	341	8			

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Zn	0	0
			1	1		
2	B	1	Total	Zn	0	0
			1	1		

- Molecule 3 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).

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

- Molecule 4 is 5,6,8-trimethoxy-1,4-dimethylquinolin-2(1H)-one (three-letter code: RZW) (formula: $C_{14}H_{17}NO_4$).
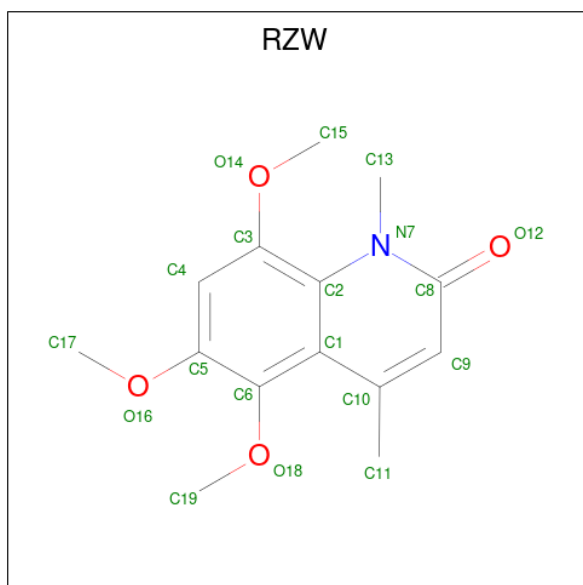
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			19	14	1	4		
4	A	1	Total	C	N	O	0	1
			38	28	2	8		
4	B	1	Total	C	N	O	0	0
			19	14	1	4		

- Molecule 5 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	176	Total	O	0	0
			176	176		
5	B	202	Total	O	0	0
			202	202		

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: Ribosyldihydronicotinamide dehydrogenase [quinone]
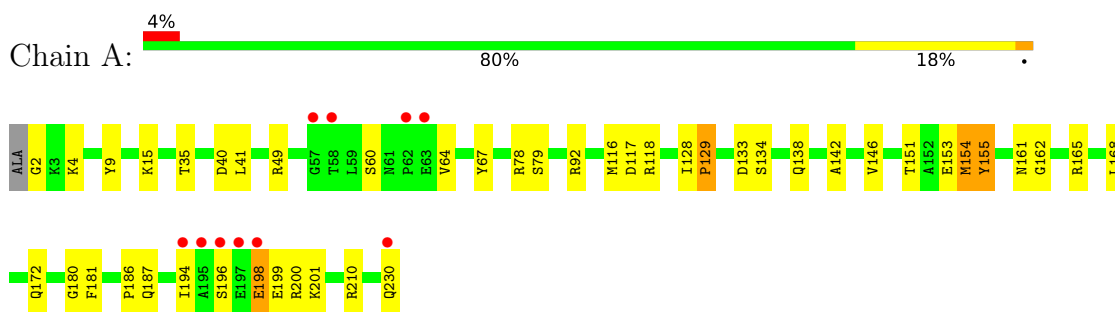
• Molecule 1: Ribosyldihydronicotinamide dehydrogenase [quinone]
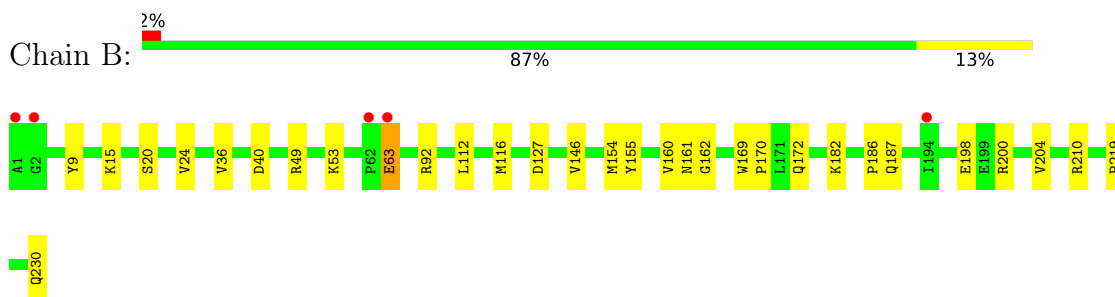
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	56.78Å　83.61Å　106.63Å 90.00°　90.00°　90.00°	Depositor
Resolution (Å)	50.00　–　1.80 44.95　–　1.80	Depositor EDS
% Data completeness (in resolution range)	98.5 (50.00-1.80) 98.6 (44.95-1.80)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	6.65 (at 1.79Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.179　,　0.215 0.178　,　0.214	Depositor DCC
R_{free} test set	2394 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å^2)	15.7	Xtriage
Anisotropy	0.701	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 46.7	EDS
L-test for twinning [2]	$<|L|>=0.50, <L^2>=0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	4214	wwPDB-VP
Average B, all atoms (Å^2)	19.0	wwPDB-VP

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

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[1] Intensities estimated from amplitudes.
[2] Theoretical values of $<|L|>$, $<L^2>$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: RZW, ZN, FAD

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	1.35	4/1869 (0.2%)	1.12	13/2535 (0.5%)
1	B	1.32	4/1883 (0.2%)	1.12	8/2554 (0.3%)
All	All	1.34	8/3752 (0.2%)	1.12	21/5089 (0.4%)

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	146	VAL	CB-CG2	-6.35	1.39	1.52
1	A	155	TYR	CD1-CE1	5.95	1.48	1.39
1	B	63	GLU	CG-CD	5.41	1.60	1.51
1	A	153	GLU	CG-CD	5.40	1.60	1.51
1	A	67	TYR	CD1-CE1	5.23	1.47	1.39
1	B	36	VAL	CB-CG2	5.04	1.63	1.52
1	B	9	TYR	CE1-CZ	5.02	1.45	1.38
1	A	9	TYR	CG-CD2	5.01	1.45	1.39

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	49	ARG	NE-CZ-NH1	10.95	125.77	120.30
1	B	116	MET	CG-SD-CE	-8.92	85.93	100.20
1	B	49	ARG	NE-CZ-NH2	-8.50	116.05	120.30
1	B	127	ASP	CB-CG-OD2	-8.36	110.77	118.30
1	A	117	ASP	CB-CG-OD1	7.11	124.70	118.30
1	A	78	ARG	NE-CZ-NH1	6.77	123.69	120.30
1	A	118	ARG	NE-CZ-NH2	-6.71	116.94	120.30
1	A	116	MET	CG-SD-CE	-6.61	89.63	100.20
1	B	40	ASP	CB-CG-OD1	6.46	124.12	118.30
1	A	146	VAL	CB-CA-C	-6.05	99.91	111.40
1	A	92	ARG	NE-CZ-NH2	-5.98	117.31	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	41	LEU	CB-CG-CD1	-5.81	101.12	111.00
1	A	40	ASP	CB-CG-OD2	-5.68	113.19	118.30
1	B	112	LEU	CB-CG-CD2	-5.66	101.38	111.00
1	A	78	ARG	NE-CZ-NH2	-5.58	117.51	120.30
1	A	92	ARG	NE-CZ-NH1	5.57	123.09	120.30
1	A	40	ASP	CB-CG-OD1	5.50	123.25	118.30
1	A	154	MET	CG-SD-CE	5.50	109.00	100.20
1	A	49	ARG	NE-CZ-NH1	5.45	123.03	120.30
1	B	154	MET	CG-SD-CE	-5.21	91.87	100.20
1	B	40	ASP	CB-CG-OD2	-5.20	113.62	118.30

There are no chirality outliers.

There are no planarity outliers.

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	1819	0	1771	26	0
1	B	1833	0	1784	13	1
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	53	0	31	6	0
3	B	53	0	31	2	0
4	A	57	0	51	11	0
4	B	19	0	17	7	0
5	A	176	0	0	3	0
5	B	202	0	0	1	0
All	All	4214	0	3685	49	1

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.

All (49) 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:24:VAL:HG11	1:B:204:VAL:CG1	2.24	0.68
1:A:196:SER:O	1:A:198:GLU:O	2.10	0.67
1:A:187:GLN:HE21	1:A:210:ARG:HH11	1.43	0.66
1:A:198:GLU:O	1:A:200:ARG:N	2.29	0.66
1:A:2:GLY:N	5:A:377:HOH:O	2.29	0.65
1:B:20:SER:O	1:B:24:VAL:HG13	1.97	0.64
1:A:172:GLN:HE22	1:A:186:PRO:HD3	1.67	0.60
1:A:187:GLN:NE2	1:A:210:ARG:HH11	2.00	0.59
1:A:128:ILE:HD11	4:A:234[A]:RZW:C2	2.34	0.57
4:A:234[B]:RZW:C13	4:A:234[B]:RZW:O14	2.54	0.55
4:B:233:RZW:C13	4:B:233:RZW:O14	2.55	0.55
1:A:161:ASN:HD21	4:A:233:RZW:H13	1.73	0.53
1:A:200:ARG:HB3	3:A:232:FAD:H2A	1.90	0.53
1:A:155:TYR:HA	1:A:162:GLY:O	2.08	0.53
1:A:200:ARG:HD2	3:A:232:FAD:N3A	2.23	0.53
4:A:233:RZW:C13	4:A:233:RZW:O14	2.56	0.53
1:A:15:LYS:O	3:A:232:FAD:H8A	2.09	0.53
1:A:134:SER:O	5:A:375:HOH:O	2.18	0.52
1:B:155:TYR:HA	1:B:162:GLY:O	2.09	0.52
1:B:169:TRP:HB3	1:B:170:PRO:HD3	1.92	0.52
1:B:161:ASN:ND2	4:B:233:RZW:H13	2.26	0.51
4:A:234[B]:RZW:O16	4:A:234[B]:RZW:H19B	2.12	0.50
4:A:234[A]:RZW:O14	4:A:234[A]:RZW:C13	2.58	0.50
1:B:161:ASN:HD21	4:B:233:RZW:H13	1.78	0.48
3:A:232:FAD:HM72	5:B:389:HOH:O	2.14	0.47
1:A:161:ASN:ND2	4:A:233:RZW:H13	2.28	0.47
1:B:187:GLN:HE21	1:B:210:ARG:HH11	1.62	0.47
4:A:234[A]:RZW:H17A	4:B:233:RZW:H9	1.96	0.47
1:A:64:VAL:HG22	1:B:15:LYS:HD3	1.97	0.47
1:A:151:THR:OG1	1:A:154:MET:HG3	2.16	0.46
1:A:165:ARG:HA	1:A:168:LEU:HD12	1.97	0.46
1:A:138:GLN:HA	1:A:180:GLY:O	2.16	0.46
1:A:187:GLN:HE21	1:A:210:ARG:NH1	2.13	0.45
3:A:232:FAD:O4	4:A:233:RZW:H15A	2.16	0.45
1:B:24:VAL:HG11	1:B:204:VAL:HG13	1.97	0.45
4:A:234[B]:RZW:H11B	4:B:233:RZW:H19A	2.00	0.43
1:A:128:ILE:HA	1:A:129:PRO:HA	1.65	0.43
4:B:233:RZW:O18	4:B:233:RZW:C11	2.66	0.43
1:A:142:ALA:HB2	1:A:181:PHE:CD1	2.53	0.43
1:B:182:LYS:HD2	1:B:219:PRO:HG3	1.99	0.43
1:B:172:GLN:HE22	1:B:186:PRO:HD3	1.84	0.42
1:A:133:ASP:HB2	5:A:296:HOH:O	2.18	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:4:LYS:HG2	1:A:35:THR:HB	2.02	0.42
1:A:200:ARG:HB3	3:A:232:FAD:C2A	2.49	0.41
1:A:151:THR:HG22	1:A:194:ILE:HD11	2.02	0.41
1:A:128:ILE:HG23	1:A:128:ILE:HD12	1.77	0.41
4:A:234[B]:RZW:H15A	4:B:233:RZW:H9	2.02	0.41
1:B:200:ARG:HD2	3:B:231:FAD:O4B	2.22	0.40
1:B:200:ARG:CD	3:B:231:FAD:O4B	2.69	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:92:ARG:NH1	1:B:230:GLN:OE1[3_554]	1.84	0.36

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	227/230 (99%)	217 (96%)	7 (3%)	3 (1%)	12	3
1	B	229/230 (100%)	219 (96%)	10 (4%)	0	100	100
All	All	456/460 (99%)	436 (96%)	17 (4%)	3 (1%)	22	10

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	198	GLU
1	A	199	GLU
1	A	129	PRO

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	194/194 (100%)	190 (98%)	4 (2%)	53	42
1	B	195/194 (100%)	191 (98%)	4 (2%)	53	42
All	All	389/388 (100%)	381 (98%)	8 (2%)	53	42

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	60	SER
1	A	79	SER
1	A	201	LYS
1	A	230	GLN
1	B	53	LYS
1	B	63	GLU
1	B	160	VAL
1	B	198	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	45	ASN
1	A	138	GLN
1	A	172	GLN
1	A	187	GLN
1	A	212	GLN
1	B	172	GLN
1	B	187	GLN

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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 8 ligands modelled in this entry, 2 are monoatomic - leaving 6 for Mogul analysis.

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	FAD	A	232	-	53,58,58	1.51	8 (15%)	68,89,89	1.52	9 (13%)
4	RZW	A	234[B]	-	20,20,20	2.40	5 (25%)	24,29,29	2.13	8 (33%)
4	RZW	B	233	-	20,20,20	1.90	5 (25%)	24,29,29	2.67	6 (25%)
4	RZW	A	234[A]	-	20,20,20	2.50	6 (30%)	24,29,29	2.18	6 (25%)
3	FAD	B	231	-	53,58,58	1.63	7 (13%)	68,89,89	1.66	15 (22%)
4	RZW	A	233	-	20,20,20	2.12	4 (20%)	24,29,29	3.08	11 (45%)

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	FAD	A	232	-	-	5/30/50/50	0/6/6/6
4	RZW	A	234[B]	-	-	0/6/6/6	0/2/2/2
4	RZW	B	233	-	-	0/6/6/6	0/2/2/2
4	RZW	A	234[A]	-	-	2/6/6/6	0/2/2/2
3	FAD	B	231	-	-	4/30/50/50	0/6/6/6
4	RZW	A	233	-	-	0/6/6/6	0/2/2/2

All (35) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	234[A]	RZW	C2-C3	7.41	1.50	1.40
4	A	234[B]	RZW	C2-C3	6.58	1.49	1.40
4	A	233	RZW	C2-C3	6.47	1.48	1.40
3	B	231	FAD	C1'-C2'	6.18	1.61	1.52
3	B	231	FAD	C2A-N3A	4.51	1.39	1.32
3	A	232	FAD	C2A-N3A	4.40	1.39	1.32
4	B	233	RZW	C2-C3	4.39	1.46	1.40
4	A	234[A]	RZW	C1-C2	4.35	1.49	1.41
4	A	234[B]	RZW	C1-C2	4.27	1.49	1.41
4	A	234[A]	RZW	C1-C6	4.12	1.50	1.40
4	B	233	RZW	C9-C10	3.87	1.40	1.35
3	A	232	FAD	C4X-N5	3.85	1.38	1.30
4	A	234[B]	RZW	C5-C6	3.78	1.49	1.41
3	B	231	FAD	C4X-N5	3.73	1.38	1.30
4	A	234[B]	RZW	C1-C6	3.68	1.49	1.40
3	A	232	FAD	C10-N1	3.68	1.40	1.33
4	A	234[A]	RZW	C5-C6	3.62	1.48	1.41
4	A	233	RZW	C1-C2	3.56	1.48	1.41
4	A	234[B]	RZW	C9-C10	3.55	1.39	1.35
3	B	231	FAD	C10-N1	3.55	1.40	1.33
3	B	231	FAD	C5'-C4'	3.48	1.56	1.51
4	A	233	RZW	C9-C10	3.40	1.39	1.35
3	A	232	FAD	C1'-C2'	3.29	1.57	1.52
4	A	234[A]	RZW	C9-C10	3.29	1.39	1.35
4	B	233	RZW	C1-C2	3.25	1.47	1.41
4	B	233	RZW	C5-C6	3.06	1.47	1.41
4	A	233	RZW	C1-C6	2.96	1.47	1.40
4	B	233	RZW	C1-C6	2.91	1.47	1.40
4	A	234[A]	RZW	C1-C10	2.35	1.50	1.46
3	A	232	FAD	O2-C2	2.34	1.28	1.24
3	A	232	FAD	C2A-N1A	2.34	1.38	1.33
3	B	231	FAD	C2A-N1A	2.32	1.38	1.33
3	A	232	FAD	C6-C5X	2.09	1.43	1.40
3	B	231	FAD	C4X-C10	-2.06	1.38	1.44
3	A	232	FAD	C9-C8	2.05	1.42	1.39

All (55) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	233	RZW	C9-C8-N7	9.75	125.35	115.42
4	B	233	RZW	C9-C8-N7	9.19	124.77	115.42
4	A	234[A]	RZW	C9-C8-N7	6.65	122.20	115.42

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	232	FAD	N3A-C2A-N1A	-6.33	118.78	128.68
4	A	234[B]	RZW	C9-C8-N7	6.13	121.67	115.42
4	B	233	RZW	C2-N7-C8	-5.73	117.66	123.03
3	B	231	FAD	N3A-C2A-N1A	-5.64	119.87	128.68
4	A	233	RZW	C15-O14-C3	5.52	125.85	117.53
4	A	233	RZW	C2-N7-C8	-4.48	118.83	123.03
4	A	233	RZW	C1-C10-C9	-4.25	115.87	118.25
4	B	233	RZW	C15-O14-C3	4.10	123.72	117.53
3	B	231	FAD	C4X-C10-N10	3.91	122.20	116.48
4	A	234[A]	RZW	O14-C3-C2	3.78	120.22	115.98
4	A	233	RZW	C2-C1-C10	3.51	122.44	119.08
3	A	232	FAD	C4X-C10-N10	3.37	121.40	116.48
4	A	234[B]	RZW	C11-C10-C1	-3.27	119.54	123.09
4	A	233	RZW	C4-C5-C6	3.23	123.88	120.22
4	A	233	RZW	O12-C8-N7	-3.18	113.41	119.58
4	A	234[B]	RZW	O12-C8-C9	-3.18	117.59	125.72
3	B	231	FAD	C4-N3-C2	-3.16	119.80	125.64
3	B	231	FAD	C4A-C5A-N7A	-3.10	106.17	109.40
3	A	232	FAD	O3'-C3'-C2'	-3.05	101.45	108.81
3	B	231	FAD	C10-N1-C2	3.03	122.97	116.90
4	A	234[A]	RZW	C2-N7-C8	-2.96	120.25	123.03
3	A	232	FAD	O4B-C1B-C2B	-2.96	102.60	106.93
4	A	234[B]	RZW	C17-O16-C5	2.92	121.93	117.53
3	B	231	FAD	O4'-C4'-C3'	-2.83	102.21	109.10
4	B	233	RZW	C8-C9-C10	-2.78	119.75	123.46
4	A	234[B]	RZW	C1-C10-C9	2.75	119.79	118.25
4	A	234[B]	RZW	O14-C3-C2	2.70	119.01	115.98
3	A	232	FAD	O4-C4-N3	-2.68	114.98	120.12
3	B	231	FAD	C9A-N10-C10	-2.67	116.60	120.77
3	B	231	FAD	C4X-C10-N1	-2.65	118.58	124.73
3	B	231	FAD	C4X-C4-N3	2.56	119.68	113.19
3	A	232	FAD	C4-C4X-N5	2.52	121.82	118.23
4	A	234[A]	RZW	O14-C3-C4	-2.52	119.79	124.12
3	A	232	FAD	C10-C4X-N5	-2.49	119.58	124.86
4	A	234[A]	RZW	O16-C5-C4	-2.43	119.93	124.12
3	B	231	FAD	C5X-C6-C7	-2.41	116.29	120.71
4	A	234[A]	RZW	O12-C8-C9	-2.38	119.62	125.72
4	A	233	RZW	C8-C9-C10	-2.36	120.32	123.46
4	A	234[B]	RZW	C2-N7-C8	-2.33	120.85	123.03
4	A	233	RZW	O16-C5-C4	-2.30	120.16	124.12
4	B	233	RZW	O12-C8-C9	-2.26	119.93	125.72
4	B	233	RZW	O12-C8-N7	-2.21	115.29	119.58

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	233	RZW	O14-C3-C2	2.18	118.42	115.98
3	B	231	FAD	C1'-C2'-C3'	-2.16	103.75	109.79
3	B	231	FAD	C5X-C9A-N10	2.12	120.15	117.95
4	A	234[B]	RZW	O14-C3-C4	-2.11	120.50	124.12
3	B	231	FAD	O5'-P-O1P	2.06	117.11	109.07
3	B	231	FAD	C5A-C6A-N6A	2.05	123.47	120.35
3	B	231	FAD	C6-C5X-C9A	2.04	121.82	118.94
4	A	233	RZW	C4-C3-C2	-2.03	117.42	120.32
3	A	232	FAD	O2B-C2B-C1B	2.02	118.31	110.85
3	A	232	FAD	C5A-C6A-N6A	-2.01	117.30	120.35

There are no chirality outliers.

All (11) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	232	FAD	C5B-O5B-PA-O1A
3	B	231	FAD	C5B-O5B-PA-O2A
4	A	234[A]	RZW	C6-C5-O16-C17
4	A	234[A]	RZW	C4-C5-O16-C17
3	A	232	FAD	C4B-C5B-O5B-PA
3	A	232	FAD	C5B-O5B-PA-O3P
3	B	231	FAD	C5B-O5B-PA-O3P
3	A	232	FAD	P-O3P-PA-O2A
3	A	232	FAD	C5B-O5B-PA-O2A
3	B	231	FAD	C5B-O5B-PA-O1A
3	B	231	FAD	C4'-C5'-O5'-P

There are no ring outliers.

6 monomers are involved in 22 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	232	FAD	6	0
4	A	234[B]	RZW	4	0
4	B	233	RZW	7	0
4	A	234[A]	RZW	3	0
3	B	231	FAD	2	0
4	A	233	RZW	4	0

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

also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand FAD A 232

Bond lengths

Bond angles

Torsions

Rings

Ligand RZW A 234 (B)

Bond lengths

Bond angles

Torsions

Rings

Ligand RZW B 233

Bond lengths

Bond angles

Torsions

Rings

Ligand RZW A 234 (A)

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD B 231

Bond lengths

Bond angles

Torsions

Rings

Ligand RZW A 233

Bond lengths

Bond angles

Torsions

Rings
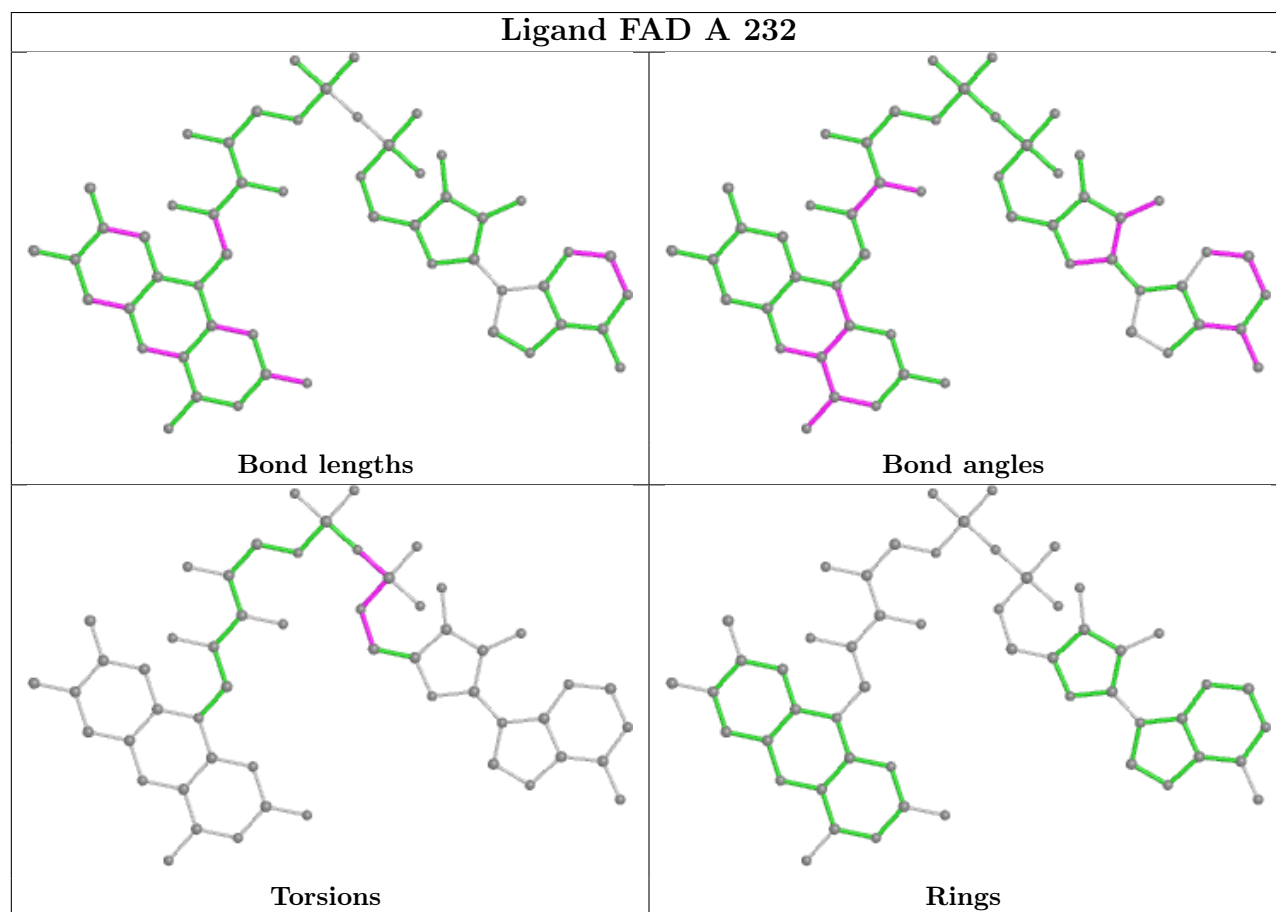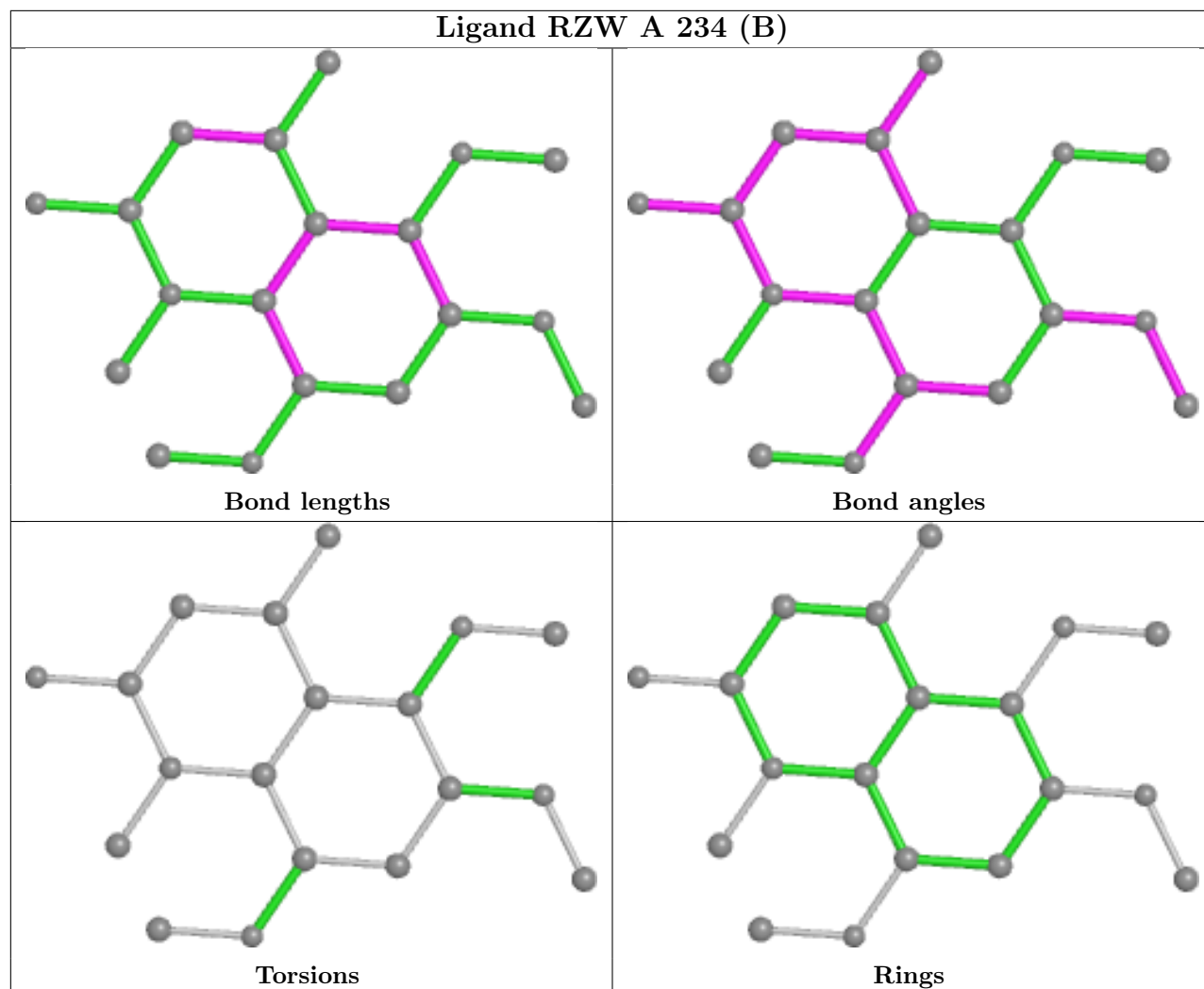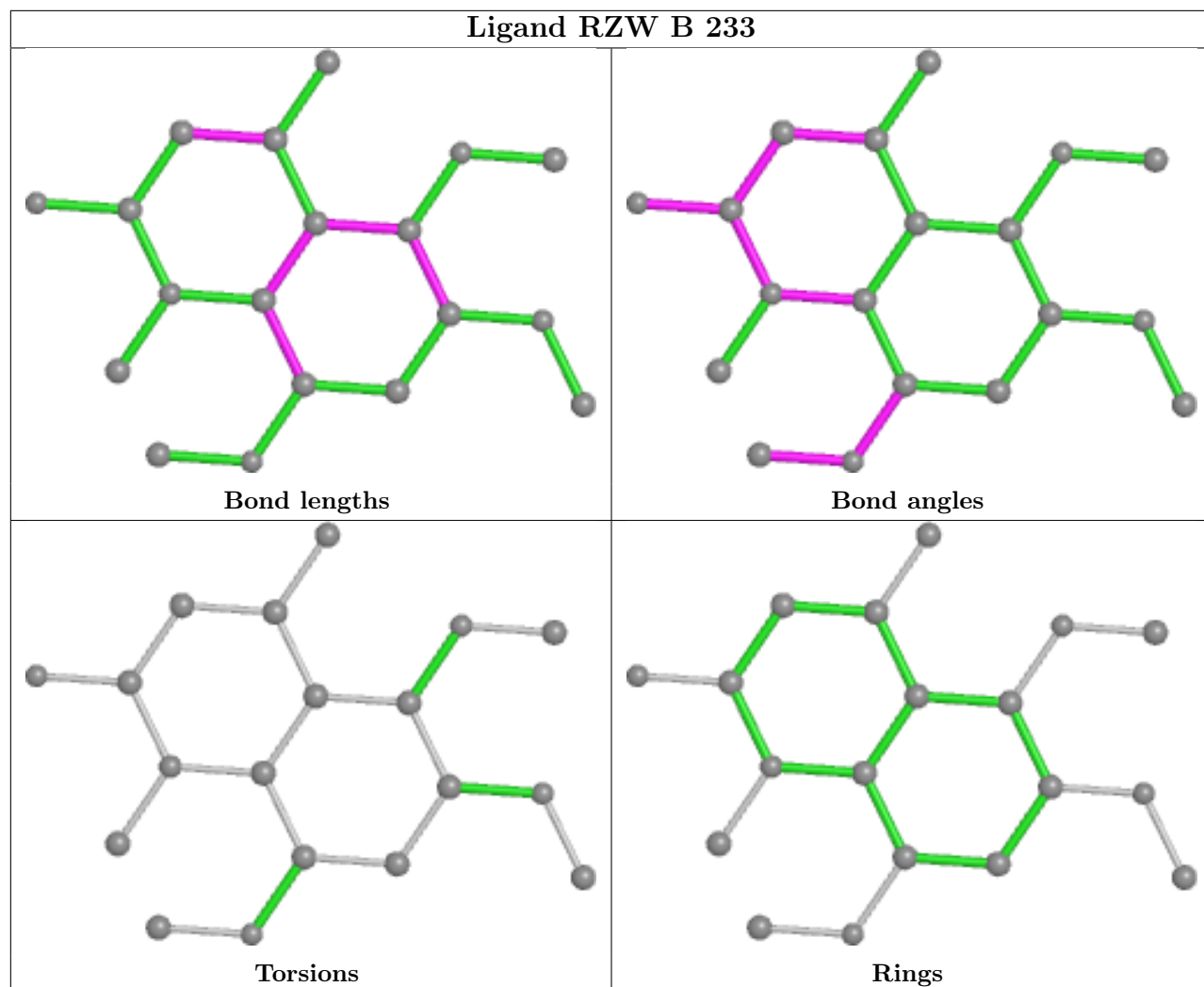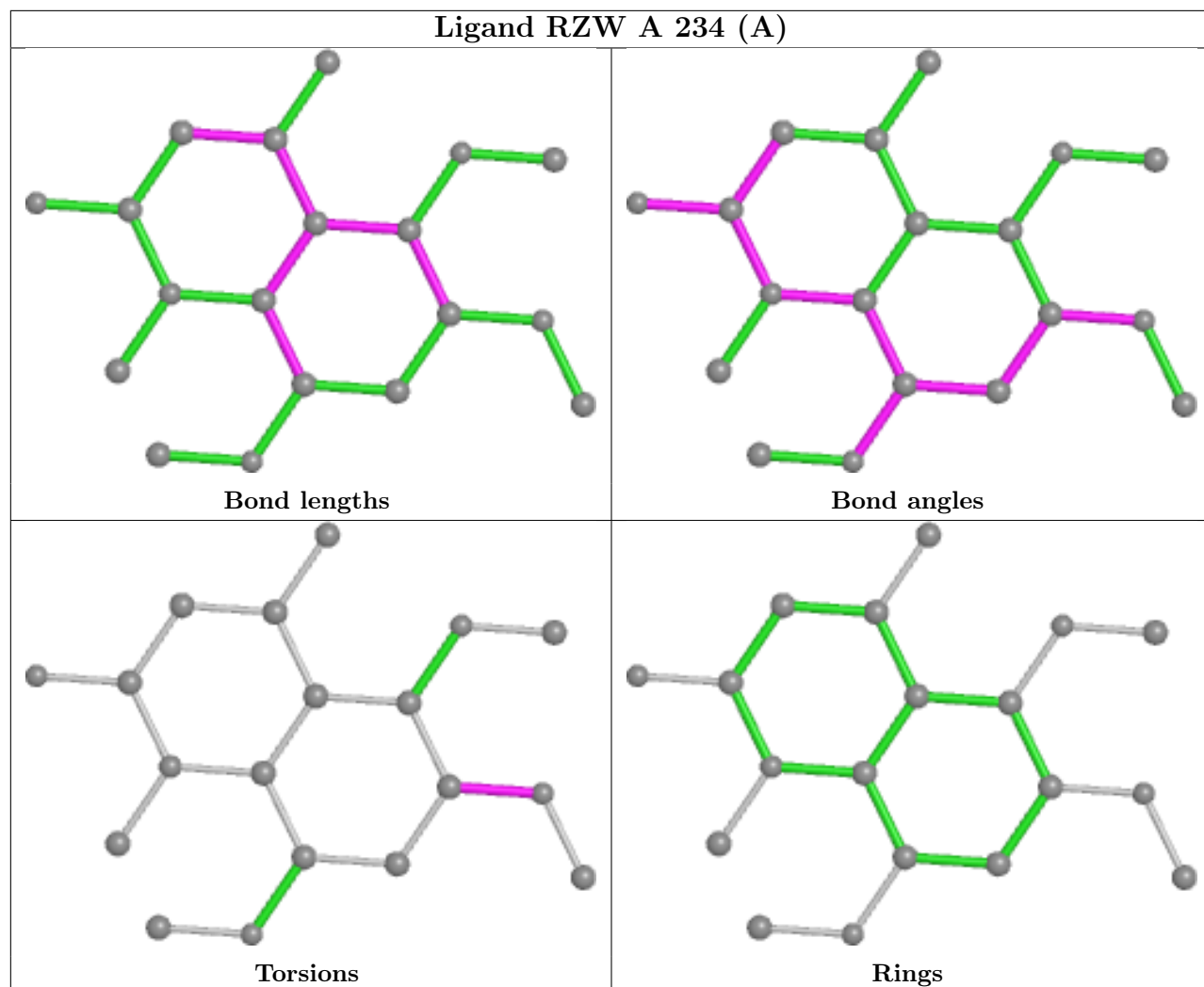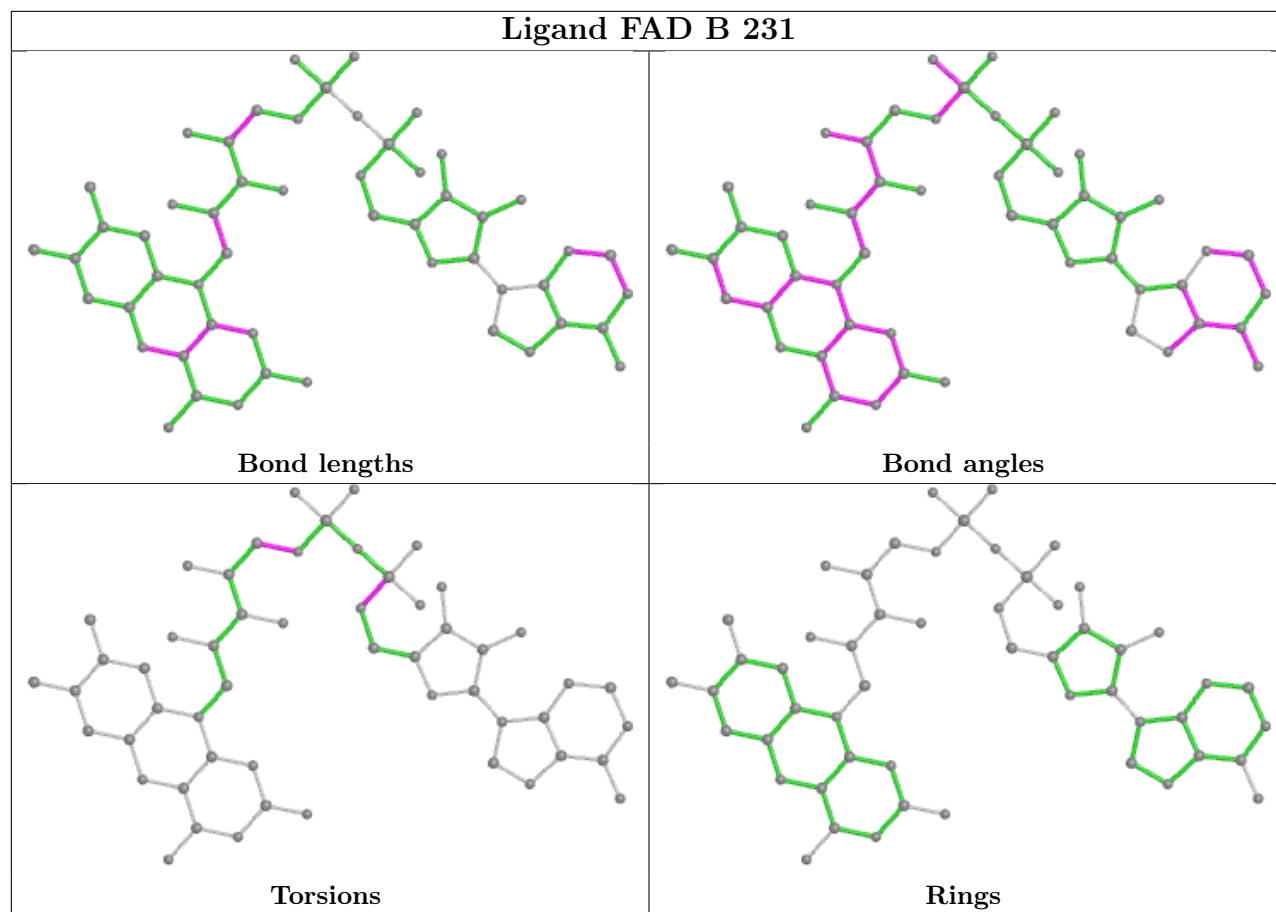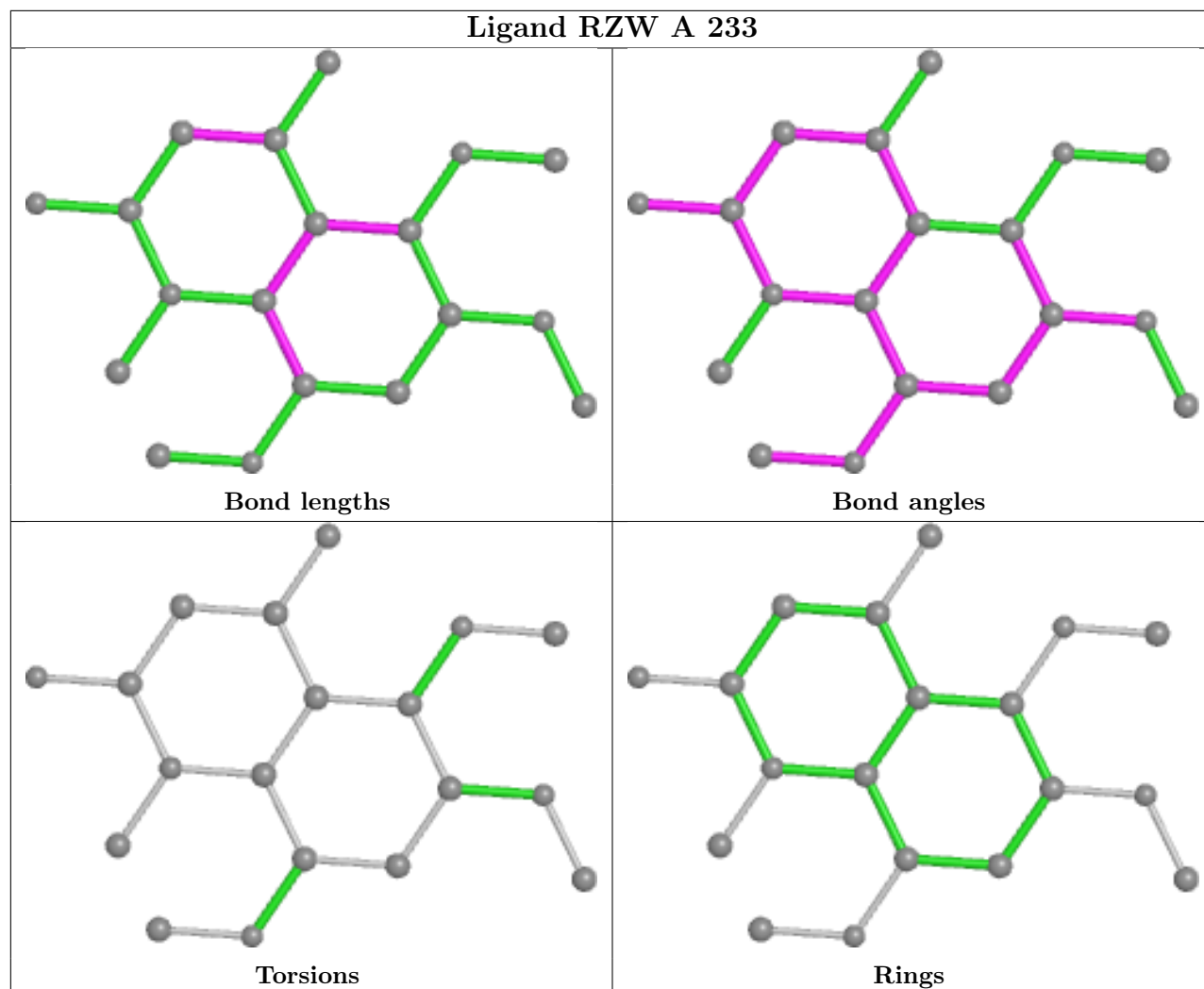
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å²)	Q<0.9
1	A	229/230 (99%)	0.10	10 (4%)	34	28	5, 18, 39, 58	0
1	B	230/230 (100%)	-0.20	5 (2%)	62	57	5, 14, 36, 51	0
All	All	459/460 (99%)	-0.05	15 (3%)	46	40	5, 16, 38, 58	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	1	ALA	6.3
1	A	57	GLY	4.9
1	A	230	GLN	3.6
1	A	63	GLU	3.5
1	B	63	GLU	3.2
1	A	196	SER	3.0
1	A	197	GLU	2.9
1	B	2	GLY	2.9
1	A	198	GLU	2.8
1	A	194	ILE	2.8
1	A	62	PRO	2.4
1	A	58	THR	2.4
1	A	195	ALA	2.4
1	B	62	PRO	2.2
1	B	194	ILE	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 ⓘ

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
4	RZW	A	234[A]	19/19	0.89	0.21	61,63,64,65	19
4	RZW	A	234[B]	19/19	0.89	0.21	22,27,30,33	19
3	FAD	A	232	53/53	0.91	0.15	7,19,64,65	0
3	FAD	B	231	53/53	0.92	0.14	8,15,49,52	0
4	RZW	A	233	19/19	0.94	0.10	12,22,26,31	0
2	ZN	A	231	1/1	0.97	0.06	21,21,21,21	0
4	RZW	B	233	19/19	0.97	0.08	11,16,21,23	0
2	ZN	B	232	1/1	0.99	0.06	15,15,15,15	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 RZW A 234 (A):

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
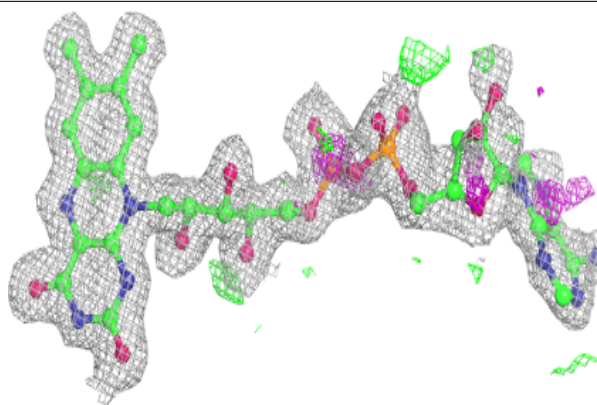and green (positive)
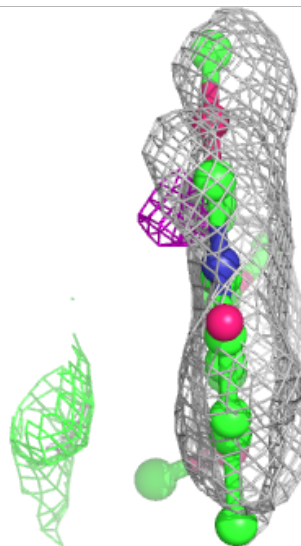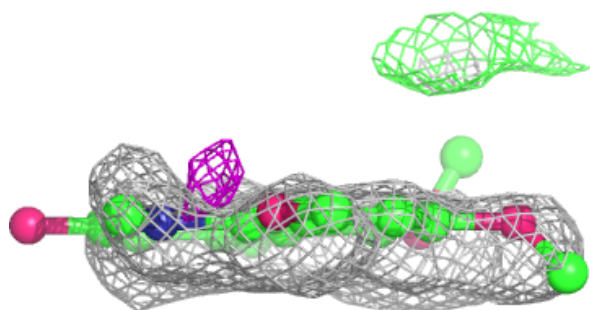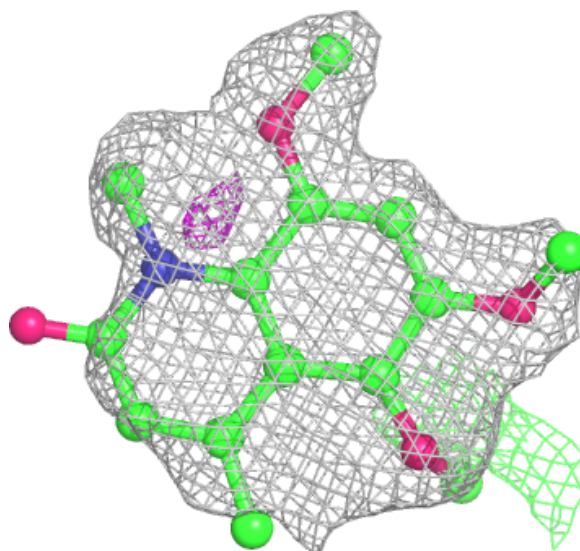
Electron density around RZW A 234 (B):

$2mF_o$-DF_c (at 0.7 rmsd) in gray
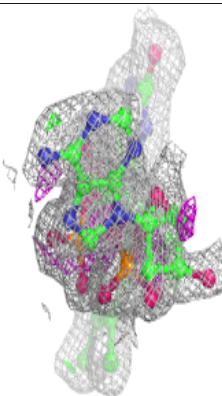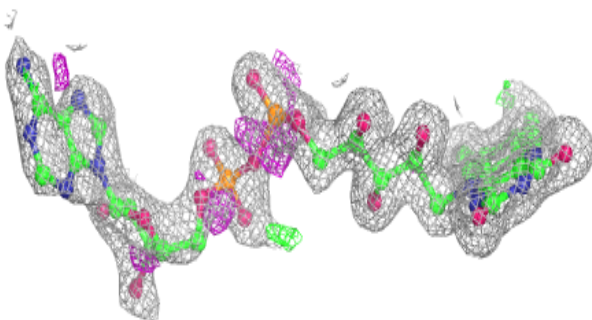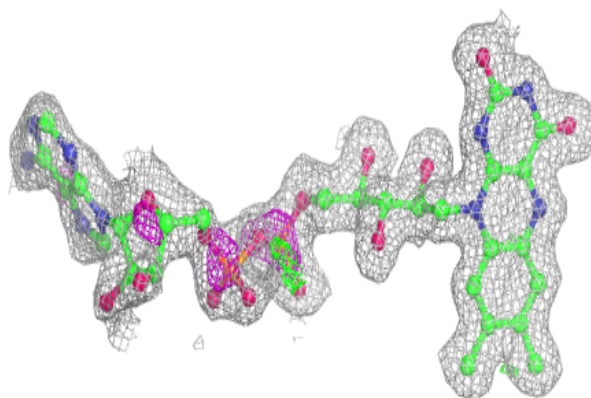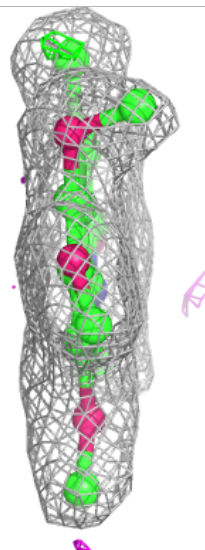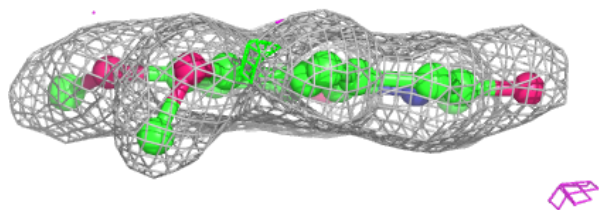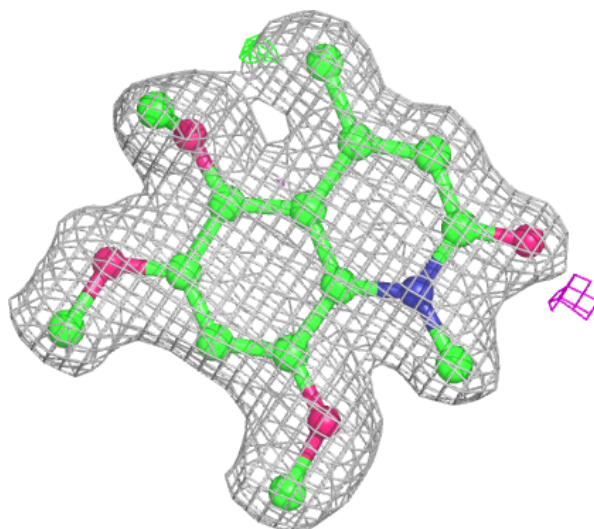mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
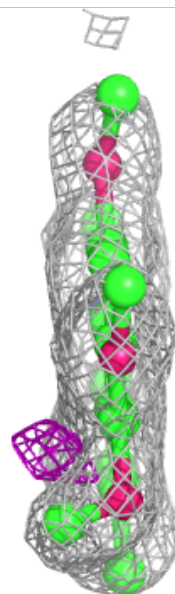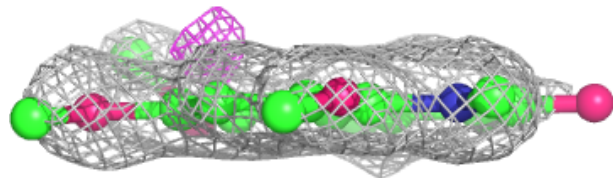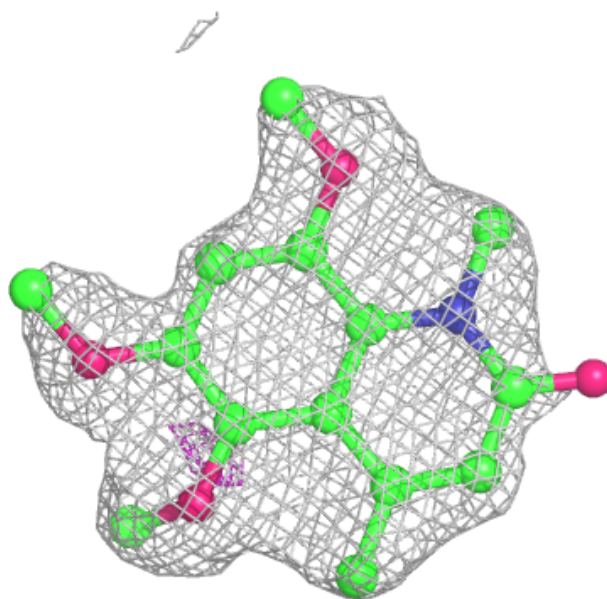
Electron density around FAD A 232:

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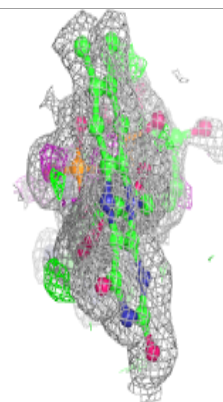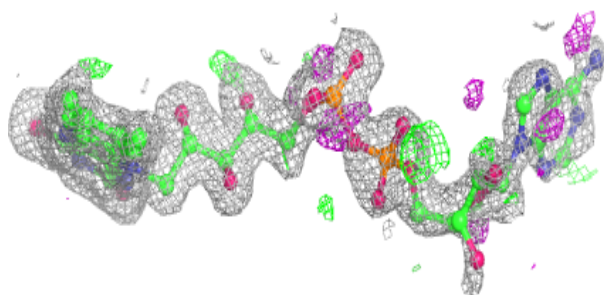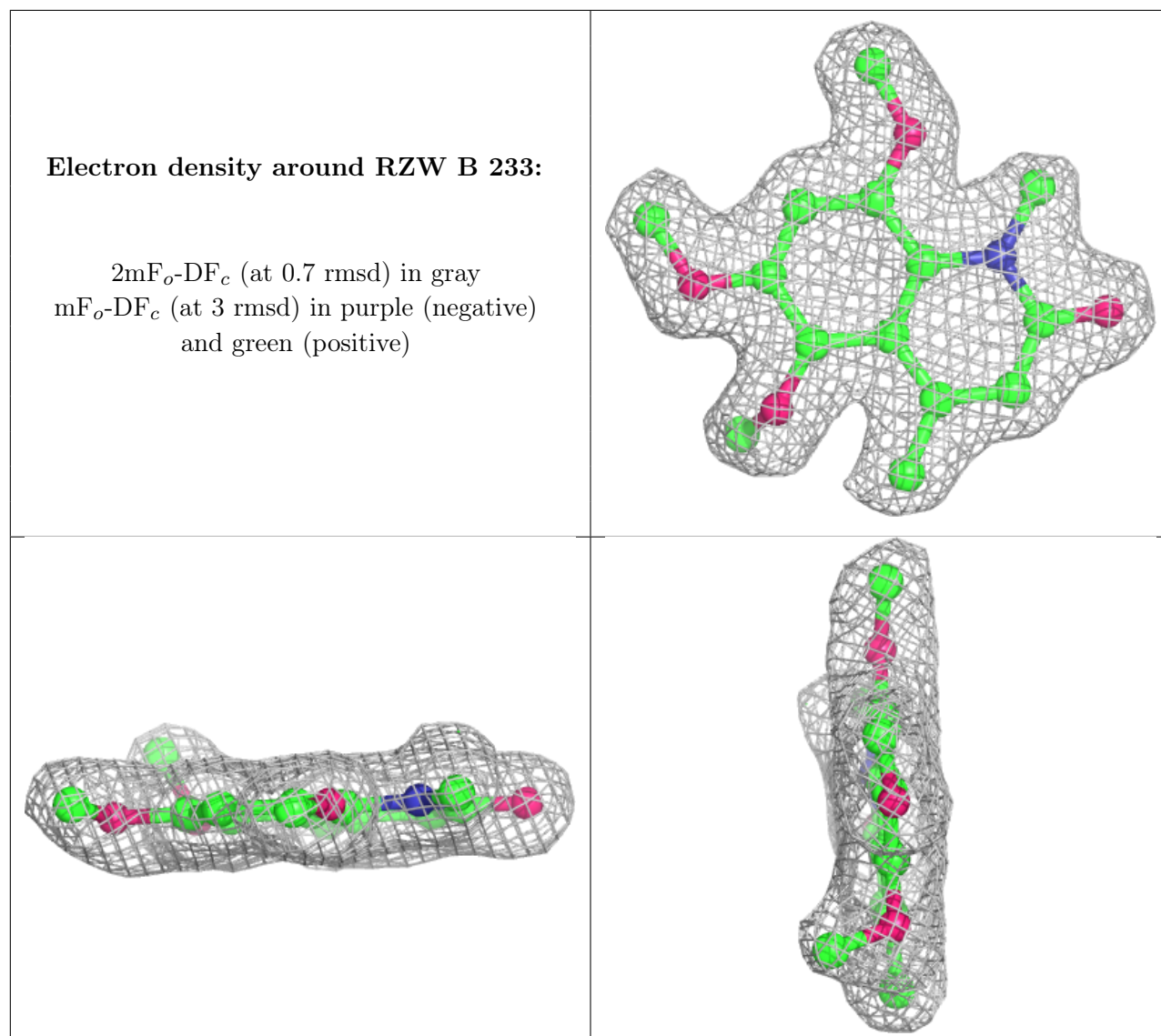

Electron density around FAD B 231:

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

Electron density around RZW A 233:

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

Electron density around RZW B 233:

$2mF_o$-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 ⓘ

There are no such residues in this entry.