WORLDWIDE PDB
PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report (i)

Oct 25, 2023 – 07:35 AM EDT

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PDB ID	:	2ZZC
Title	:	Crystal structure of NADP(H):human thioredoxin reductase I
Authors	:	Lo, Y.C.; Ko, T.P.; Wang, A.H.J.
Deposited on	:	2009-02-09
Resolution	:	2.60 Å(reported)

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 2.60 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.

■ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution
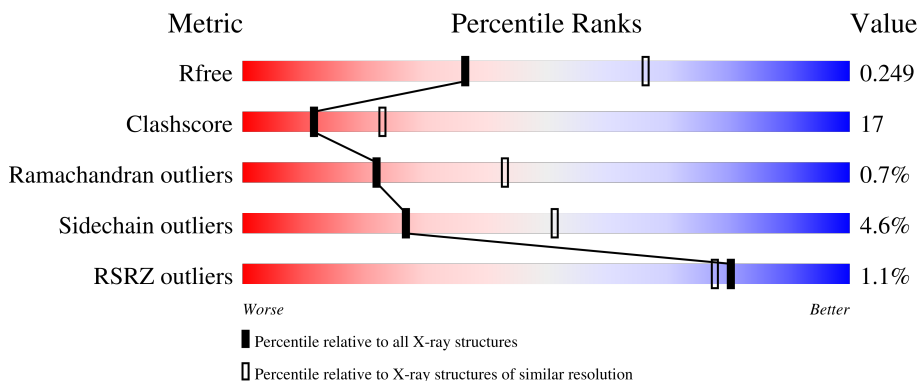
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	3163 (2.60-2.60)
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)
RSRZ outliers	127900	3104 (2.60-2.60)

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	513	60% 32% · 5%
1	B	513	69% 24% · 6%
1	C	513	60% 31% · 5%
1	D	513	64% 27% · 6%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 16283 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 Thioredoxin reductase 1, cytoplasmic.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	485	Total	C	N	O	S	0	0	0
			3750	2384	640	707	19			
1	B	484	Total	C	N	O	S	0	0	0
			3741	2379	638	705	19			
1	C	485	Total	C	N	O	S	0	0	0
			3750	2384	640	707	19			
1	D	484	Total	C	N	O	S	0	0	0
			3741	2379	638	705	19			

There are 56 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-13	MET	-	expression tag	UNP Q16881
A	-12	ALA	-	expression tag	UNP Q16881
A	-11	HIS	-	expression tag	UNP Q16881
A	-10	HIS	-	expression tag	UNP Q16881
A	-9	HIS	-	expression tag	UNP Q16881
A	-8	HIS	-	expression tag	UNP Q16881
A	-7	HIS	-	expression tag	UNP Q16881
A	-6	HIS	-	expression tag	UNP Q16881
A	-5	VAL	-	expression tag	UNP Q16881
A	-4	ASP	-	expression tag	UNP Q16881
A	-3	ASP	-	expression tag	UNP Q16881
A	-2	ASP	-	expression tag	UNP Q16881
A	-1	ASP	-	expression tag	UNP Q16881
A	498	CYS	U	SEE REMARK 999	UNP Q16881
B	-13	MET	-	expression tag	UNP Q16881
B	-12	ALA	-	expression tag	UNP Q16881
B	-11	HIS	-	expression tag	UNP Q16881
B	-10	HIS	-	expression tag	UNP Q16881
B	-9	HIS	-	expression tag	UNP Q16881
B	-8	HIS	-	expression tag	UNP Q16881
B	-7	HIS	-	expression tag	UNP Q16881

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-6	HIS	-	expression tag	UNP Q16881
B	-5	VAL	-	expression tag	UNP Q16881
B	-4	ASP	-	expression tag	UNP Q16881
B	-3	ASP	-	expression tag	UNP Q16881
B	-2	ASP	-	expression tag	UNP Q16881
B	-1	ASP	-	expression tag	UNP Q16881
B	498	CYS	U	SEE REMARK 999	UNP Q16881
C	-13	MET	-	expression tag	UNP Q16881
C	-12	ALA	-	expression tag	UNP Q16881
C	-11	HIS	-	expression tag	UNP Q16881
C	-10	HIS	-	expression tag	UNP Q16881
C	-9	HIS	-	expression tag	UNP Q16881
C	-8	HIS	-	expression tag	UNP Q16881
C	-7	HIS	-	expression tag	UNP Q16881
C	-6	HIS	-	expression tag	UNP Q16881
C	-5	VAL	-	expression tag	UNP Q16881
C	-4	ASP	-	expression tag	UNP Q16881
C	-3	ASP	-	expression tag	UNP Q16881
C	-2	ASP	-	expression tag	UNP Q16881
C	-1	ASP	-	expression tag	UNP Q16881
C	498	CYS	U	SEE REMARK 999	UNP Q16881
D	-13	MET	-	expression tag	UNP Q16881
D	-12	ALA	-	expression tag	UNP Q16881
D	-11	HIS	-	expression tag	UNP Q16881
D	-10	HIS	-	expression tag	UNP Q16881
D	-9	HIS	-	expression tag	UNP Q16881
D	-8	HIS	-	expression tag	UNP Q16881
D	-7	HIS	-	expression tag	UNP Q16881
D	-6	HIS	-	expression tag	UNP Q16881
D	-5	VAL	-	expression tag	UNP Q16881
D	-4	ASP	-	expression tag	UNP Q16881
D	-3	ASP	-	expression tag	UNP Q16881
D	-2	ASP	-	expression tag	UNP Q16881
D	-1	ASP	-	expression tag	UNP Q16881
D	498	CYS	U	SEE REMARK 999	UNP Q16881

- Molecule 2 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).

FAD

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

- Molecule 3 is NADP NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NAP) (formula: $C_{21}H_{28}N_7O_{17}P_3$).

NAP
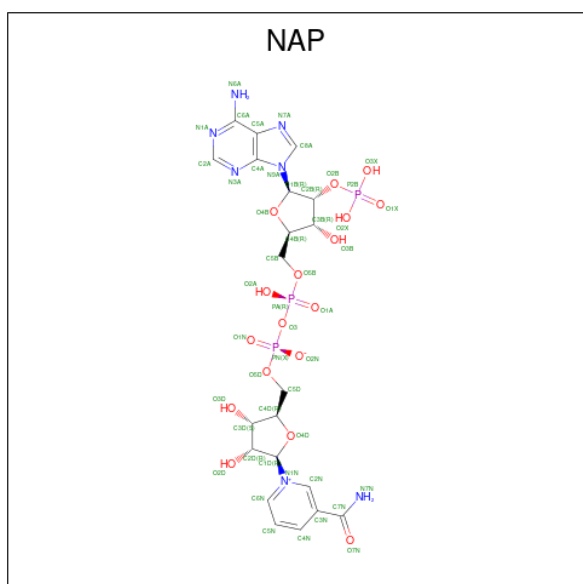
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
3	B	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
3	C	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
3	D	1	Total	C	N	O	P	0	0
			48	21	7	17	3		

• Molecule 4 is water.

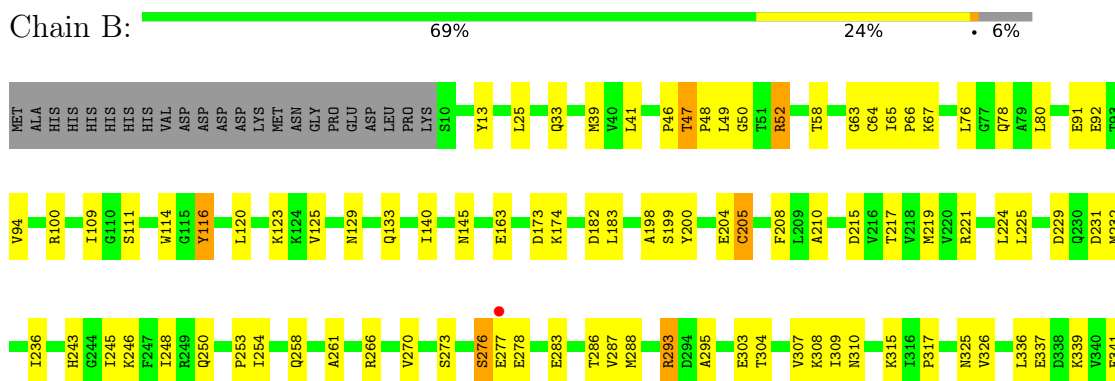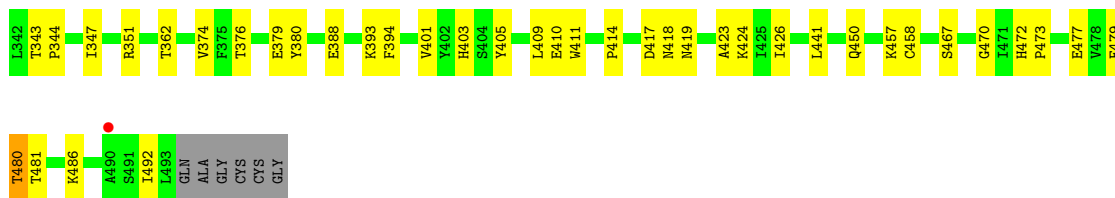| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	246	Total	O	0	0
			246	246		
4	B	260	Total	O	0	0
			260	260		
4	C	184	Total	O	0	0
			184	184		
4	D	207	Total	O	0	0
			207	207		

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.
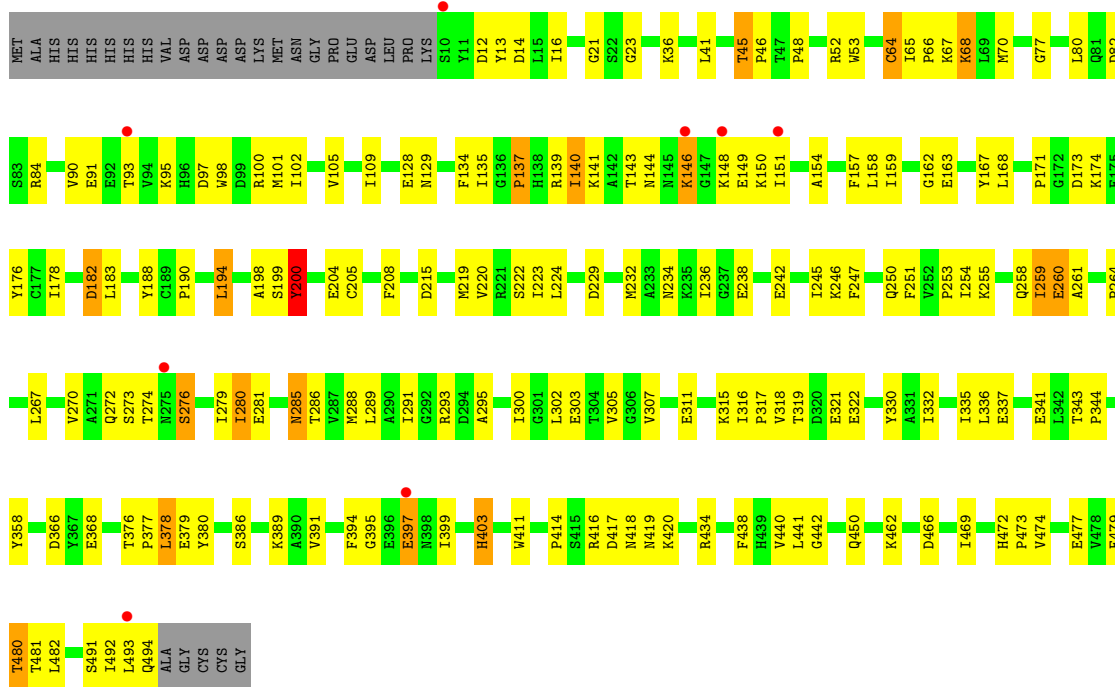
- Molecule 1: Thioredoxin reductase 1, cytoplasmic

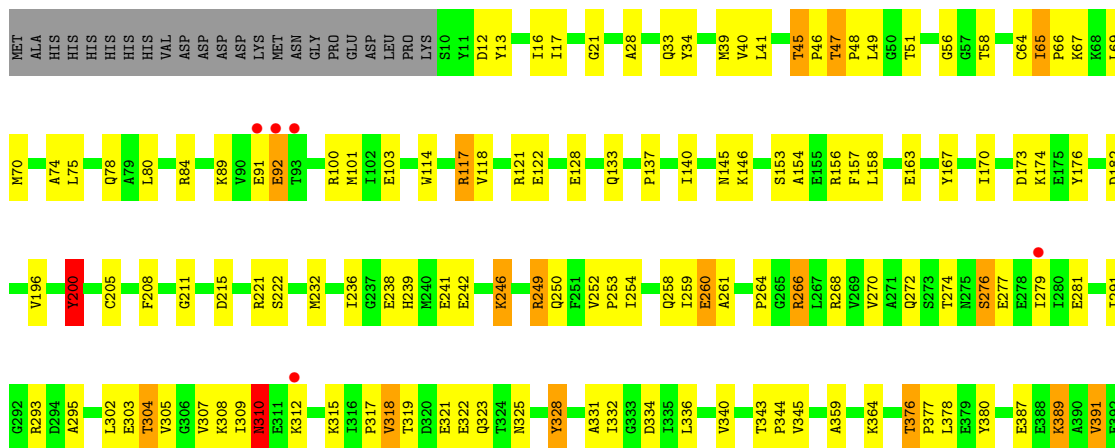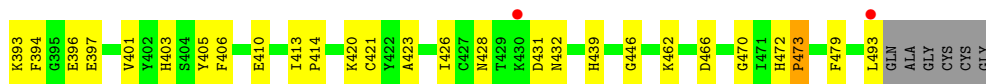Chain A:

- Molecule 1: Thioredoxin reductase 1, cytoplasmic

Chain B:

L342 T343 P344 I347 R351 T362 V374 F375 T376 E379 Y380 E388 K393 F394 V401 Y402 H403 S404 Y405 L409 E410 W411 P414 D417 N418 N419 A423 K424 I425 I426 L441 Q450 K457 C458 S467 G470 I471 H472 P473 E477 V478 F479

T480 T481 K486 A490 S491 I492 L493 GLN ALA GLY CYS CYS GLY

• Molecule 1: Thioredoxin reductase 1, cytoplasmic

Chain C:

MET ALA HIS HIS HIS HIS HIS VAL ASP ASP ASP LYS MET ASN GLY PRO GLU ASP LEU PRO LYS S10 Y11 D12 Y13 D14 L15 I16 G21 S22 G23 K36 L41 T45 P46 T47 P48 R52 W53 C64 I65 P66 K67 K68 L69 M70 G77 L80 Q81 D82

S83 R84 V90 E91 E92 T93 V94 K95 H96 D97 W98 D99 R100 M101 I102 V105 I109 E128 N129 F134 I135 G136 P137 H138 R139 I140 K141 A142 T143 N144 N145 K146 G147 K148 E149 K150 I151 A154 F157 L158 I159 G162 E163 Y167 L168 P171 G172 D173 K174 E175

Y176 C177 I178 D182 L183 Y188 C189 P190 L194 A198 S199 Y200 E204 C205 F208 D215 M219 V220 R221 S222 I223 L224 D229 M232 A233 N234 K235 I236 G237 E238 E242 I245 K246 F247 Q250 F251 V252 P253 I254 K255 Q258 I259 E260 A261 P264

L267 V270 A271 Q272 S273 T274 N275 S276 I279 I280 E281 N285 T286 V287 M288 L289 A290 I291 G292 R293 D294 A295 I300 G301 L302 E303 T304 V305 G306 V307 E311 K315 I316 P317 V318 T319 D320 E321 E322 Y330 A331 I332 I335 L336 E337 E341 L342 T343 P344

Y358 D366 Y367 E368 T376 P377 L378 E379 Y380 S386 K389 A390 V391 F394 G395 E396 E397 N398 I399 H403 W411 P414 S415 R416 D417 N418 N419 K420 R434 F438 H439 V440 L441 G442 Q450 K462 D466 I469 H472 P473 V474 E477 V478 F479

T480 T481 L482 S491 I492 L493 Q494 ALA GLY CYS CYS GLY

• Molecule 1: Thioredoxin reductase 1, cytoplasmic

Chain D:

MET ALA HIS HIS HIS HIS HIS VAL ASP ASP ASP LYS MET ASN GLY PRO GLU ASP LEU PRO LYS S10 Y11 D12 Y13 I16 I17 G21 A28 Q33 Y34 M39 V40 L41 T45 P46 T47 P48 L49 G50 T51 G56 G57 T58 C64 I65 P66 K67 K68 L69

M70 A74 L75 Q78 A79 L80 R84 K89 V90 E91 E92 T93 R100 M101 I102 E103 W114 R117 V118 R121 E122 E128 Q133 P137 I140 N145 K146 S153 A154 E155 R156 F157 L158 E163 Y167 I170 D173 K174 E175 Y176 D182

V196 Y200 C205 F208 G211 D215 R221 S222 M232 I236 G237 E238 H239 M240 E241 E242 K246 R249 Q250 F251 V252 P253 I254 Q258 I259 E260 A261 P264 G265 R266 L267 R268 V269 V270 A271 Q272 S273 T274 N275 S276 E277 E278 I279 I280 E281 I291

G292 R293 D294 A295 L302 E303 T304 V305 G306 V307 K308 I309 N310 E311 K312 K315 I316 P317 V318 T319 D320 E321 E322 Q323 T324 N325 Y328 A331 I332 G333 D334 L336 V340 T343 P344 V345 A359 K364 T376 P377 L378 E379 Y380 E387 E388 K389 A390 V391 E392

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	120.86Å 135.17Å 346.63Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.60 29.92 – 2.60	Depositor EDS
% Data completeness (in resolution range)	94.3 (30.00-2.60) 94.3 (29.92-2.60)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.83 (at 2.61Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.211 , 0.260 0.200 , 0.249	Depositor DCC
R_{free} test set	4147 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	52.7	Xtriage
Anisotropy	0.215	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 53.8	EDS
L-test for twinning[2]	$< |L| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	16283	wwPDB-VP
Average B, all atoms (Å^2)	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.38% 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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: NAP, 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	0.94	2/3824 (0.1%)	0.96	4/5178 (0.1%)
1	B	0.97	2/3815 (0.1%)	0.95	2/5166 (0.0%)
1	C	0.89	1/3824 (0.0%)	0.91	4/5178 (0.1%)
1	D	0.93	2/3815 (0.1%)	0.94	2/5166 (0.0%)
All	All	0.93	7/15278 (0.0%)	0.94	12/20688 (0.1%)

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
1	C	0	1
1	D	0	3
All	All	0	5

The worst 5 of 7 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	91	GLU	CG-CD	6.97	1.62	1.51
1	D	103	GLU	CG-CD	6.89	1.62	1.51
1	B	114	TRP	CB-CG	-6.17	1.39	1.50
1	D	397	GLU	CG-CD	5.87	1.60	1.51
1	C	53	TRP	CB-CG	-5.44	1.40	1.50

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	194	LEU	CA-CB-CG	-5.94	101.64	115.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	182	ASP	CB-CG-OD2	5.74	123.46	118.30
1	B	293	ARG	NE-CZ-NH1	-5.70	117.45	120.30
1	A	82	ASP	CB-CG-OD1	5.67	123.40	118.30
1	D	310	ASN	N-CA-C	-5.61	95.84	111.00

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	116	TYR	Sidechain
1	C	200	TYR	Sidechain
1	D	200	TYR	Sidechain
1	D	328	TYR	Sidechain
1	D	405	TYR	Sidechain

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	3750	0	3759	151	0
1	B	3741	0	3751	110	0
1	C	3750	0	3759	167	0
1	D	3741	0	3751	134	0
2	A	53	0	31	0	0
2	B	53	0	31	0	0
2	C	53	0	31	1	0
2	D	53	0	31	2	0
3	A	48	0	25	3	0
3	B	48	0	25	4	0
3	C	48	0	25	3	0
3	D	48	0	25	3	0
4	A	246	0	0	5	0
4	B	260	0	0	7	0
4	C	184	0	0	5	0
4	D	207	0	0	1	0
All	All	16283	0	15244	534	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 17.

The worst 5 of 534 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:308:LYS:N	1:B:325:ASN:HD21	1.43	1.17
1:C:419:ASN:ND2	1:C:494:GLN:HB2	1.62	1.13
1:D:302:LEU:HD22	1:D:307:VAL:HG21	1.27	1.12
1:B:308:LYS:H	1:B:325:ASN:ND2	1.48	1.09
1:C:183:LEU:HD22	1:C:288:MET:HE1	1.37	1.06

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	483/513 (94%)	446 (92%)	33 (7%)	4 (1%)	19	39
1	B	482/513 (94%)	455 (94%)	26 (5%)	1 (0%)	47	71
1	C	483/513 (94%)	443 (92%)	34 (7%)	6 (1%)	13	27
1	D	482/513 (94%)	443 (92%)	36 (8%)	3 (1%)	25	47
All	All	1930/2052 (94%)	1787 (93%)	129 (7%)	14 (1%)	22	43

5 of 14 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	260	GLU
1	A	200	TYR
1	C	200	TYR
1	D	260	GLU
1	A	260	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	399/422 (94%)	383 (96%)	16 (4%)	31	57
1	B	398/422 (94%)	386 (97%)	12 (3%)	41	67
1	C	399/422 (94%)	378 (95%)	21 (5%)	22	45
1	D	398/422 (94%)	373 (94%)	25 (6%)	18	36
All	All	1594/1688 (94%)	1520 (95%)	74 (5%)	27	51

5 of 74 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	145	ASN
1	D	396	GLU
1	D	249	ARG
1	D	310	ASN
1	B	362	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 32 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	258	GLN
1	D	355	GLN
1	B	250	GLN
1	B	145	ASN
1	D	419	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)

8 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	NAP	A	901	-	45,52,52	1.62	7 (15%)	56,80,80	1.18	6 (10%)
2	FAD	A	900	-	53,58,58	1.40	7 (13%)	68,89,89	1.58	10 (14%)
2	FAD	C	900	-	53,58,58	1.56	9 (16%)	68,89,89	1.56	11 (16%)
3	NAP	D	901	-	45,52,52	1.50	8 (17%)	56,80,80	1.25	5 (8%)
3	NAP	C	901	-	45,52,52	1.77	8 (17%)	56,80,80	1.23	4 (7%)
2	FAD	D	900	-	53,58,58	1.42	6 (11%)	68,89,89	1.55	13 (19%)
3	NAP	B	901	-	45,52,52	1.67	7 (15%)	56,80,80	1.28	3 (5%)
2	FAD	B	900	-	53,58,58	1.54	8 (15%)	68,89,89	1.65	12 (17%)

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	NAP	A	901	-	-	4/31/67/67	0/5/5/5
2	FAD	A	900	-	-	3/30/50/50	0/6/6/6
2	FAD	C	900	-	-	3/30/50/50	0/6/6/6
3	NAP	D	901	-	-	7/31/67/67	0/5/5/5
3	NAP	C	901	-	-	9/31/67/67	0/5/5/5
2	FAD	D	900	-	-	2/30/50/50	0/6/6/6
3	NAP	B	901	-	-	6/31/67/67	0/5/5/5
2	FAD	B	900	-	-	2/30/50/50	0/6/6/6

The worst 5 of 60 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	901	NAP	C2N-N1N	5.76	1.42	1.35
2	B	900	FAD	O4B-C1B	5.09	1.48	1.41
3	A	901	NAP	O4B-C1B	4.87	1.47	1.41
3	C	901	NAP	C2N-N1N	4.74	1.40	1.35
2	C	900	FAD	O4B-C1B	4.72	1.47	1.41

The worst 5 of 64 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	900	FAD	P-O3P-PA	-6.26	111.34	132.83
2	C	900	FAD	P-O3P-PA	-5.43	114.19	132.83
2	B	900	FAD	P-O3P-PA	-5.37	114.40	132.83
2	D	900	FAD	P-O3P-PA	-5.28	114.69	132.83
2	C	900	FAD	N3A-C2A-N1A	-4.76	121.25	128.68

There are no chirality outliers.

5 of 36 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	900	FAD	O4B-C4B-C5B-O5B
2	B	900	FAD	O4B-C4B-C5B-O5B
2	C	900	FAD	O4B-C4B-C5B-O5B
3	A	901	NAP	C2B-O2B-P2B-O1X
3	A	901	NAP	C5D-O5D-PN-O1N

There are no ring outliers.

6 monomers are involved in 16 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	901	NAP	3	0
2	C	900	FAD	1	0
3	D	901	NAP	3	0
3	C	901	NAP	3	0
2	D	900	FAD	2	0
3	B	901	NAP	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 NAP A 901

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD A 900

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD C 900

Bond lengths

Bond angles

Torsions

Rings

Ligand NAP D 901

Bond lengths

Bond angles

Torsions

Rings

Ligand NAP C 901

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD D 900

Bond lengths

Bond angles

Torsions

Rings

Ligand NAP B 901

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD B 900

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 ⓘ

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	A	485/513 (94%)	-0.31	4 (0%)	86	84	26, 50, 70, 84	0
1	B	484/513 (94%)	-0.51	2 (0%)	92	91	28, 44, 63, 87	0
1	C	485/513 (94%)	-0.25	8 (1%)	72	68	34, 53, 74, 94	0
1	D	484/513 (94%)	-0.38	7 (1%)	75	71	28, 49, 70, 89	0
All	All	1938/2052 (94%)	-0.36	21 (1%)	80	78	26, 49, 71, 94	0

The worst 5 of 21 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	493	LEU	3.8
1	C	275	ASN	3.2
1	D	92	GLU	3.1
1	C	10	SER	2.7
1	D	279	ILE	2.7

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

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

6.3 Carbohydrates ⓘ

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.

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
3	NAP	C	901	48/48	0.94	0.13	61,72,86,87	0
2	FAD	C	900	53/53	0.96	0.16	38,48,65,66	0
3	NAP	A	901	48/48	0.96	0.13	49,64,87,87	0
2	FAD	A	900	53/53	0.96	0.17	42,50,68,68	0
3	NAP	B	901	48/48	0.97	0.13	45,53,63,64	0
2	FAD	D	900	53/53	0.97	0.12	30,42,49,51	0
3	NAP	D	901	48/48	0.97	0.12	51,60,83,85	0
2	FAD	B	900	53/53	0.98	0.12	30,37,43,43	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 NAP C 901:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
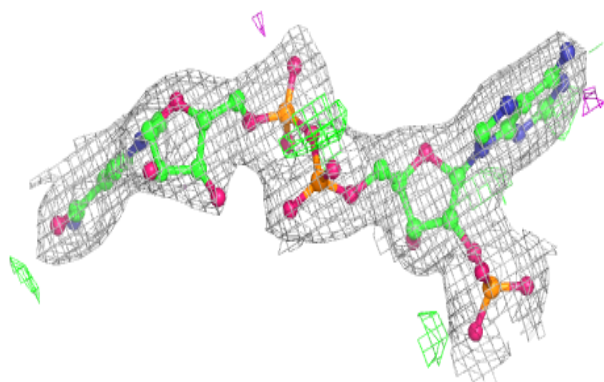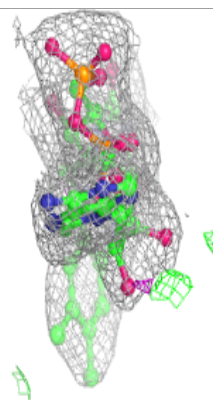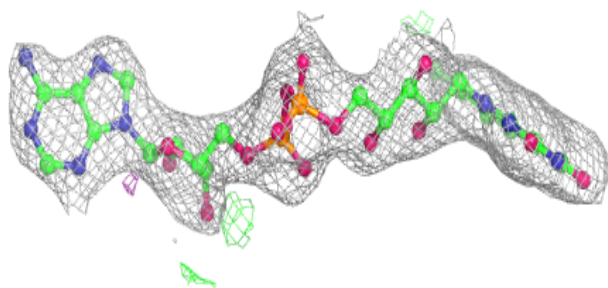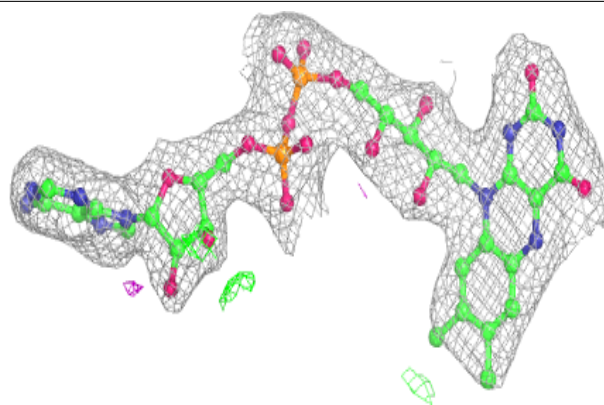mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)
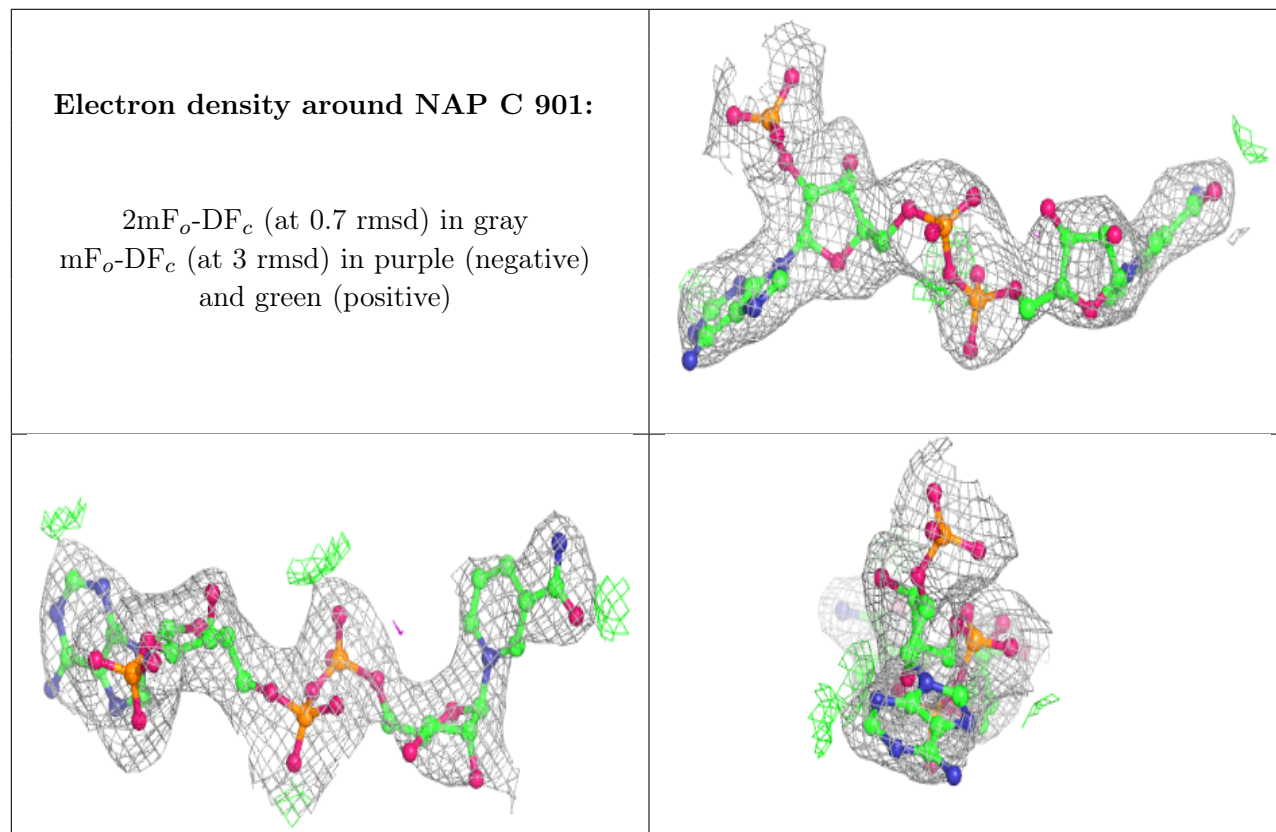
Electron density around FAD C 900:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
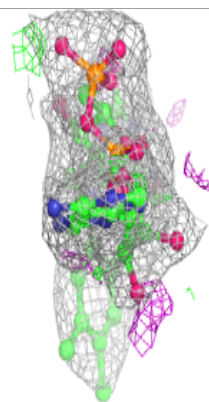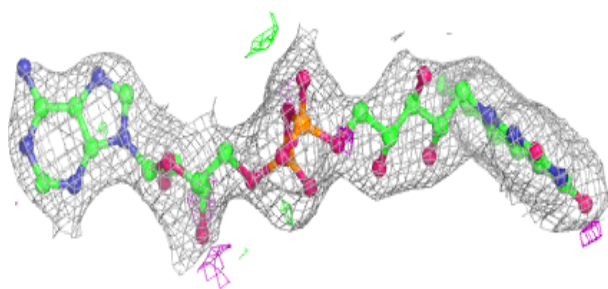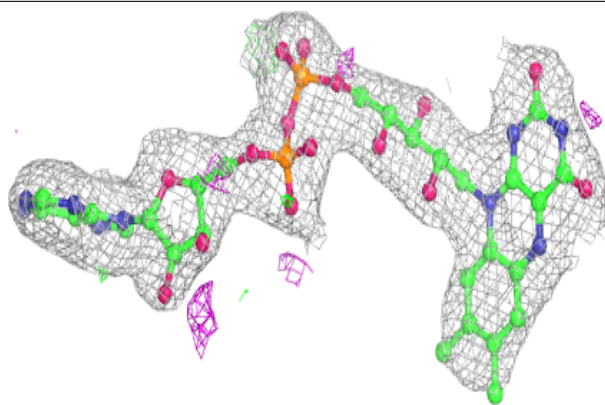
Electron density around NAP A 901:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
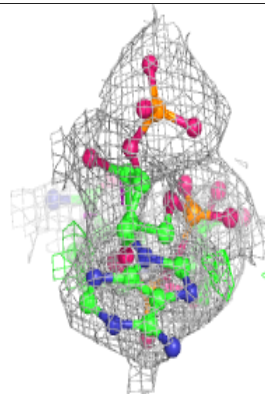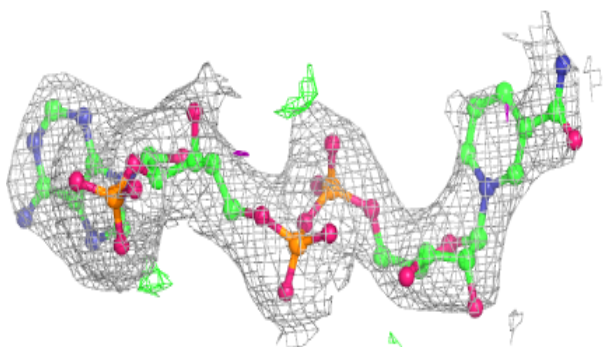$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
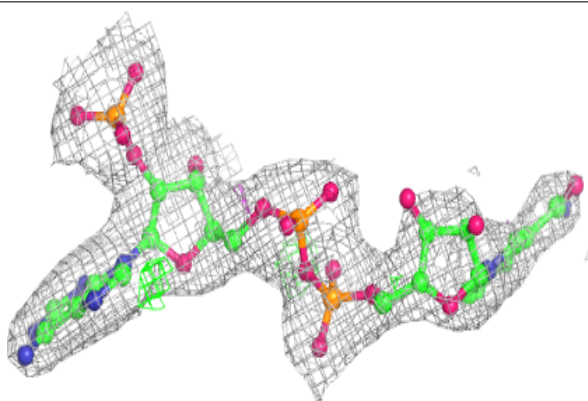and green (positive)
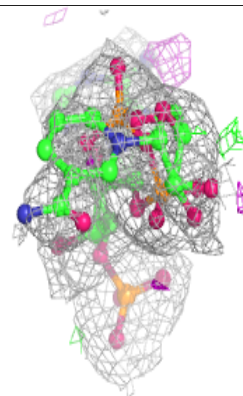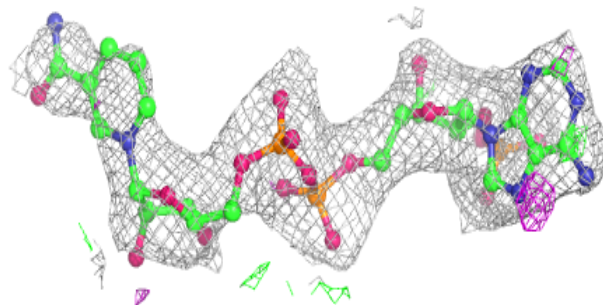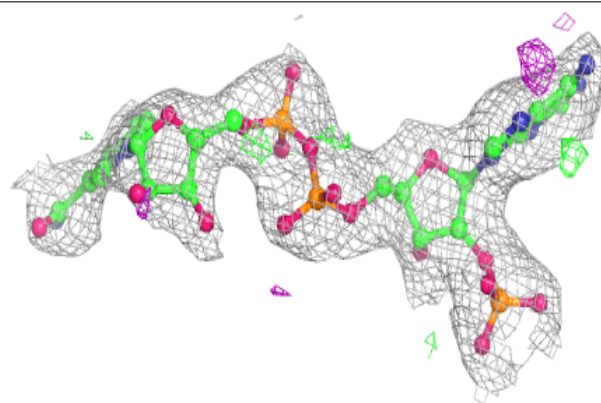
Electron density around FAD A 900:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
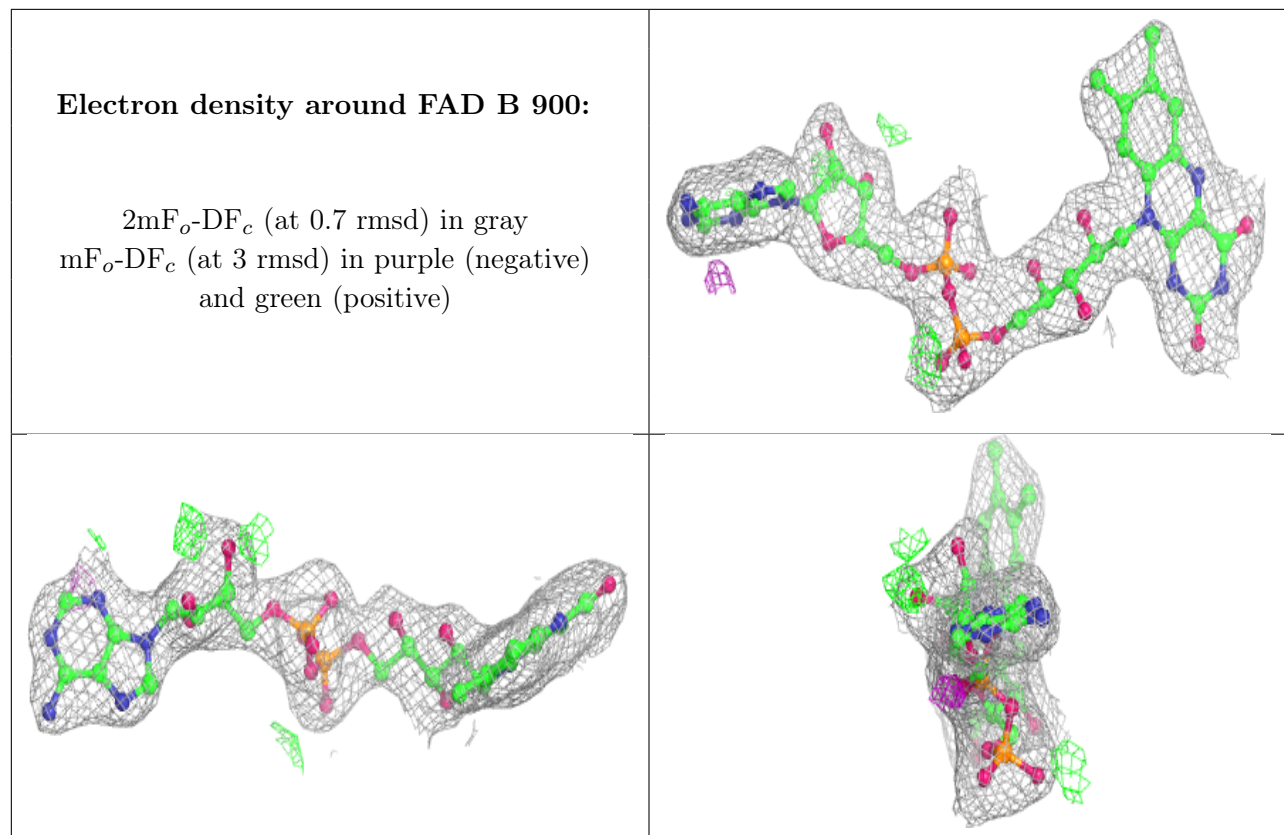mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
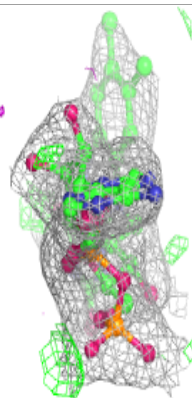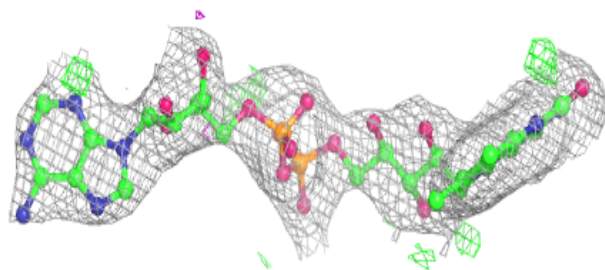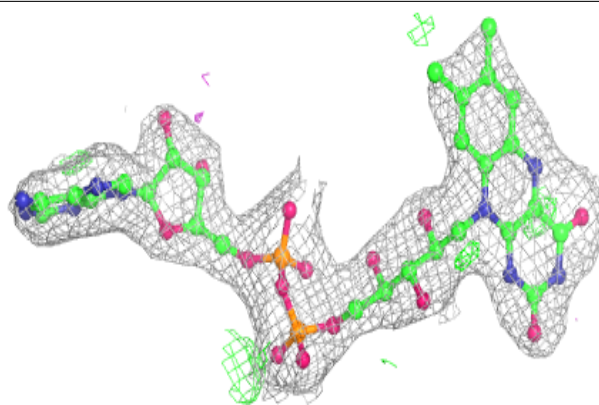
Electron density around NAP B 901:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
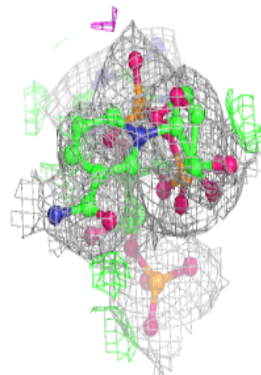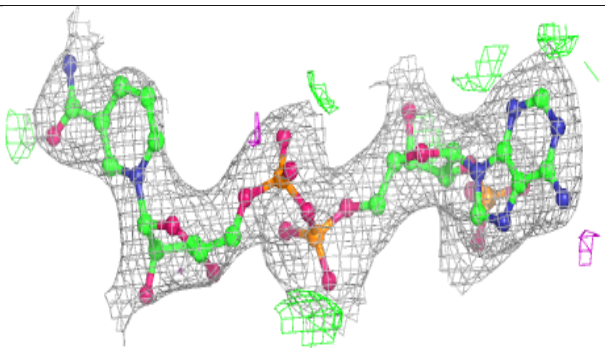
Electron density around FAD D 900:

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

Electron density around NAP D 901:

$2mF_o\text{-}DF_c$ (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 900:

$2mF_o$-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.