



wwPDB X-ray Structure Validation Summary Report ⓘ

May 15, 2020 – 01:09 am BST

PDB ID : 2VF8
Title : Crystal structure of UvrA2 from *Deinococcus radiodurans*
Authors : Timmins, J.; Gordon, E.; Caria, S.; Leonard, G.; Kuo, M.S.; Monchois, V.;
McSweeney, S.
Deposited on : 2007-10-31
Resolution : 3.00 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

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

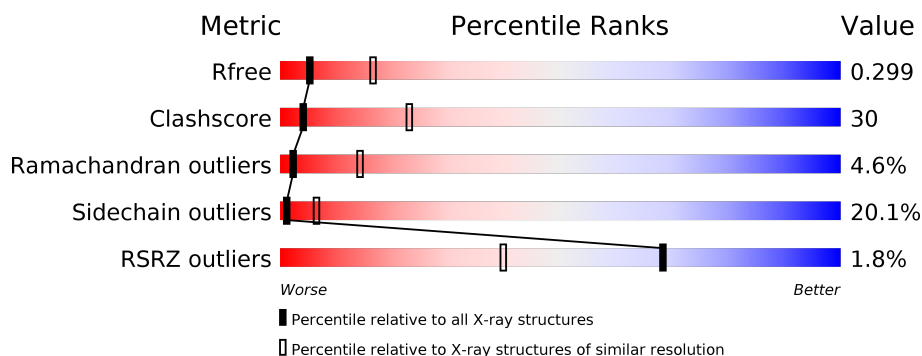
The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
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)	:	2.11



i

X-RAY DIFFRACTION

A.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R _{free}	130704	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (3.00-3.00)

Mol	Chain	Length	Quality of chain
1	A	842	
1	B	842	

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 12843 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 EXCINUCLEASE ABC SUBUNIT A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	806	Total	C	N	O	S	0	26	0
			6182	3879	1119	1165	19			
1	B	835	Total	C	N	O	S	0	26	0
			6402	4014	1154	1215	19			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	746	ARG	GLN	engineered mutation	UNP Q9RYW8
B	746	ARG	GLN	engineered mutation	UNP Q9RYW8

- Molecule 2 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	B	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	B	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



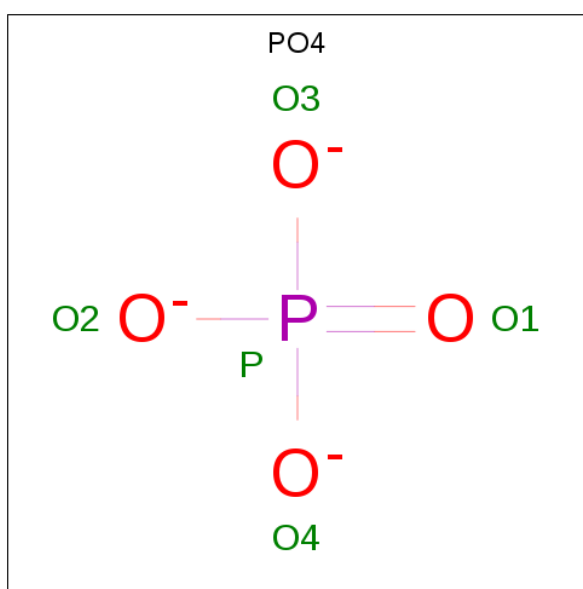
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	1
			5	4	1		
4	A	1	Total	O	S	0	1
			5	4	1		
4	A	1	Total	O	S	0	1
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total	O	S	0	1
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	1
			5	4	1		
4	B	1	Total	O	S	0	1
			5	4	1		

- Molecule 5 is PHOSPHATE ION (three-letter code: PO4) (formula: O₄P).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	B	1	Total	O	P	0	1
			5	4	1		

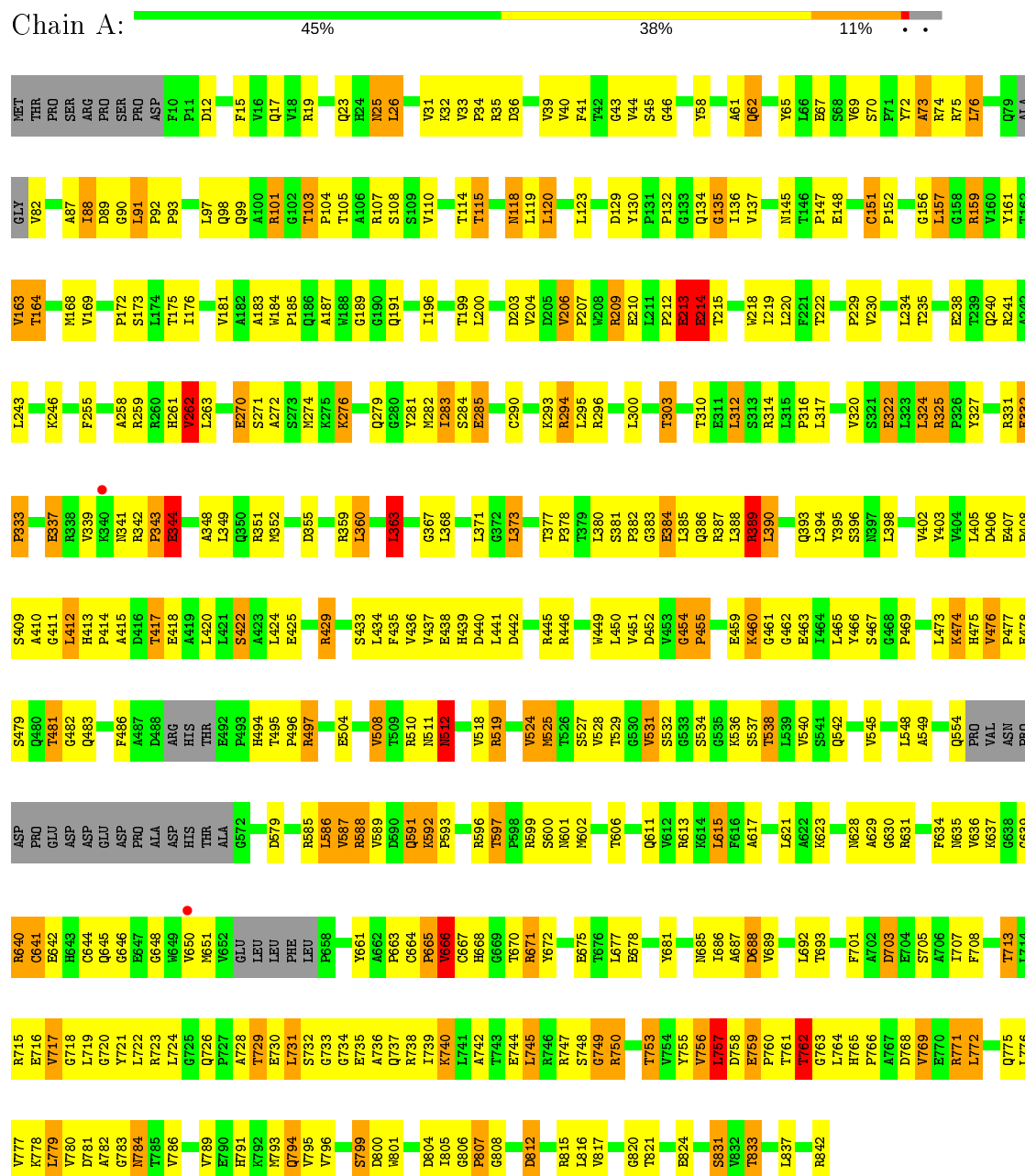
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	37	Total	O	0	0
			37	37		
6	B	65	Total	O	0	0
			65	65		

3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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: EXCINUCLEASE ABC SUBUNIT A



[illegible]

4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	149.63Å 171.04Å 204.21Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	102.06 – 3.00 49.31 – 3.00	Depositor EDS
% Data completeness (in resolution range)	96.0 (102.06-3.00) 96.0 (49.31-3.00)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.08 (at 3.01Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.217 , 0.294 0.235 , 0.299	Depositor DCC
R_{free} test set	2543 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å ²)	71.8	Xtriage
Anisotropy	0.057	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 59.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	12843	wwPDB-VP
Average B, all atoms (Å ²)	67.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.14% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, PO4, ADP, SO4

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	0.87	3/6312 (0.0%)	0.88	8/8572 (0.1%)
1	B	0.95	23/6543 (0.4%)	1.02	22/8899 (0.2%)
All	All	0.91	26/12855 (0.2%)	0.95	30/17471 (0.2%)

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	A	0	3
1	B	0	4
All	All	0	7

The worst 5 of 26 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	270	GLU	CD-OE2	29.64	1.58	1.25
1	A	270	GLU	CD-OE1	17.04	1.44	1.25
1	B	290	CYS	CB-SG	-12.89	1.60	1.82
1	B	438	GLU	N-CA	11.50	1.69	1.46
1	B	466	TYR	C-O	10.13	1.42	1.23

The worst 5 of 30 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	452	ASP	CB-CG-OD1	-18.46	101.69	118.30
1	B	452	ASP	CB-CG-OD2	10.81	128.03	118.30
1	B	436	VAL	CG1-CB-CG2	8.45	124.42	110.90
1	B	44	VAL	O-C-N	-7.97	109.95	122.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	157	LEU	CB-CG-CD1	-6.29	100.30	111.00

There are no chirality outliers.

5 of 7 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	454	GLY	Peptide
1	A	666	VAL	Peptide
1	A	806	GLY	Peptide
1	B	45	SER	Mainchain
1	B	455	PRO	Mainchain

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	6182	0	6036	368	0
1	B	6402	0	6222	382	0
2	A	54	0	24	5	0
2	B	54	0	24	10	0
3	A	2	0	0	0	0
3	B	2	0	0	1	0
4	A	15	0	0	0	0
4	B	25	0	0	0	0
5	B	5	0	0	0	0
6	A	37	0	0	5	0
6	B	65	0	0	9	0
All	All	12843	0	12306	750	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 30.

The worst 5 of 750 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:276:LYS:CE	1:A:276:LYS:NZ	1.69	1.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:438:GLU:N	1:B:438:GLU:CA	1.69	1.51
1:A:759:GLU:OE2	1:A:791[A]:HIS:CD2	1.83	1.30
1:B:413:HIS:CE1	1:B:833:THR:HG22	1.77	1.19
1:B:413:HIS:HE1	1:B:833:THR:HG22	1.06	1.17

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	797/842 (95%)	652 (82%)	110 (14%)	35 (4%)	2	15
1	B	834/842 (99%)	675 (81%)	119 (14%)	40 (5%)	2	13
All	All	1631/1684 (97%)	1327 (81%)	229 (14%)	75 (5%)	2	14

5 of 75 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	213[A]	GLU
1	A	214[A]	GLU
1	A	262	VAL
1	A	455	PRO
1	A	663	PRO

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	652/683 (96%)	523 (80%)	129 (20%)	1	7
1	B	676/683 (99%)	538 (80%)	138 (20%)	1	6
All	All	1328/1366 (97%)	1061 (80%)	267 (20%)	1	6

5 of 267 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	795	VAL
1	B	120	LEU
1	B	717	VAL
1	A	816	LEU
1	B	40	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 39 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	635	ASN
1	B	186	GLN
1	B	773[A]	GLN
1	A	737	GLN
1	A	775	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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

Of 17 ligands modelled in this entry, 4 are monoatomic - leaving 13 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
4	SO4	A	1848[A]	-	4,4,4	0.13	0	6,6,6	0.23	0
4	SO4	B	1848[A]	-	4,4,4	0.28	0	6,6,6	0.10	0
4	SO4	B	1847	-	4,4,4	0.23	0	6,6,6	0.39	0
2	ADP	A	1844	-	24,29,29	1.10	1 (4%)	29,45,45	1.79	11 (37%)
5	PO4	B	1852[A]	-	4,4,4	0.69	0	6,6,6	0.71	0
4	SO4	B	1849	-	4,4,4	0.21	0	6,6,6	0.37	0
2	ADP	B	1843	-	24,29,29	1.29	3 (12%)	29,45,45	1.62	5 (17%)
4	SO4	A	1847[A]	-	4,4,4	0.11	0	6,6,6	0.43	0
4	SO4	B	1850[A]	-	4,4,4	0.18	0	6,6,6	0.20	0
2	ADP	B	1844	-	24,29,29	1.12	3 (12%)	29,45,45	1.44	5 (17%)
4	SO4	B	1851[A]	-	4,4,4	0.20	0	6,6,6	0.36	0
4	SO4	A	1849[A]	-	4,4,4	0.17	0	6,6,6	0.18	0
2	ADP	A	1843	-	24,29,29	1.12	2 (8%)	29,45,45	1.54	4 (13%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	ADP	B	1844	-	-	4/12/32/32	0/3/3/3
2	ADP	B	1843	-	-	3/12/32/32	0/3/3/3
2	ADP	A	1843	-	-	2/12/32/32	0/3/3/3
2	ADP	A	1844	-	-	0/12/32/32	0/3/3/3

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1843	ADP	C5-C4	3.09	1.49	1.40
2	A	1843	ADP	C5-C4	2.64	1.47	1.40
2	A	1844	ADP	C2'-C1'	-2.43	1.50	1.53
2	B	1843	ADP	C2'-C1'	-2.37	1.50	1.53
2	B	1844	ADP	O4'-C4'	-2.22	1.40	1.45

The worst 5 of 25 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1843	ADP	PA-O3A-PB	-4.21	118.37	132.83
2	B	1843	ADP	N6-C6-N1	4.18	127.26	118.57
2	A	1844	ADP	N3-C2-N1	-4.16	122.17	128.68
2	B	1843	ADP	N3-C2-N1	-3.67	122.94	128.68
2	B	1844	ADP	N3-C2-N1	-3.51	123.19	128.68

There are no chirality outliers.

5 of 9 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1843	ADP	C5'-O5'-PA-O2A
2	B	1844	ADP	C5'-O5'-PA-O3A
2	A	1843	ADP	O4'-C4'-C5'-O5'
2	A	1843	ADP	C3'-C4'-C5'-O5'
2	B	1844	ADP	O4'-C4'-C5'-O5'

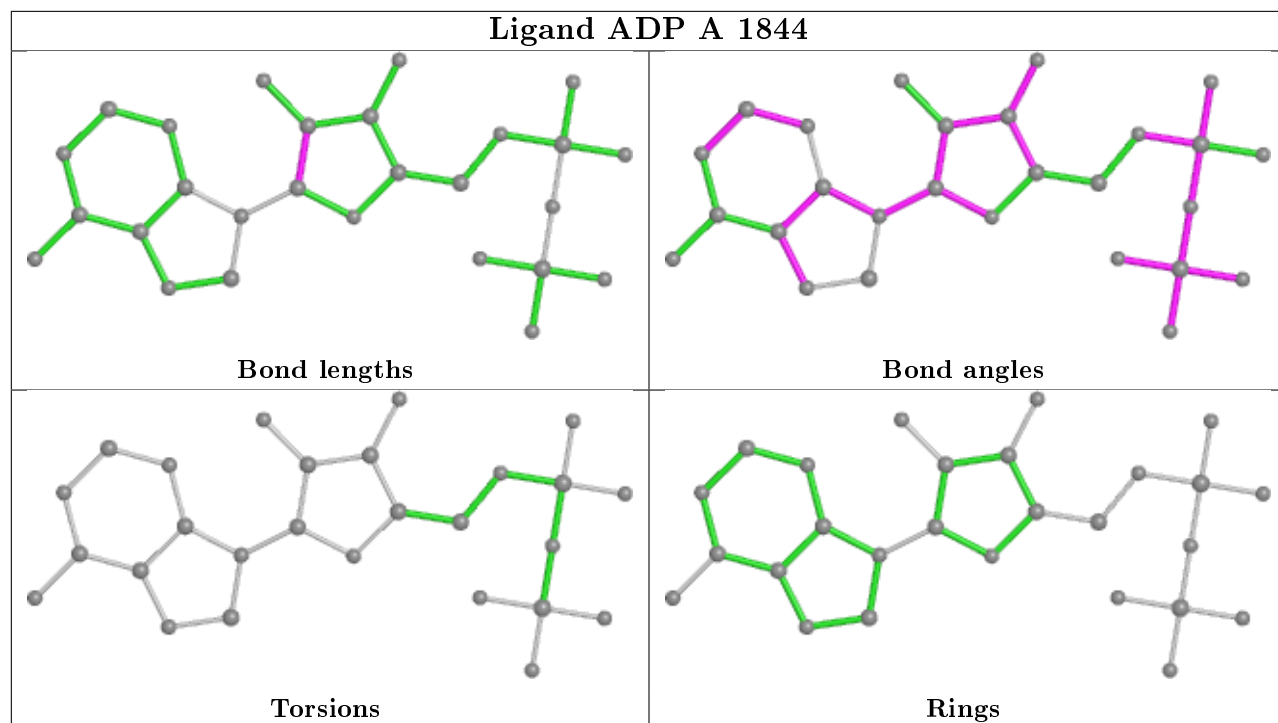
There are no ring outliers.

4 monomers are involved in 15 short contacts:

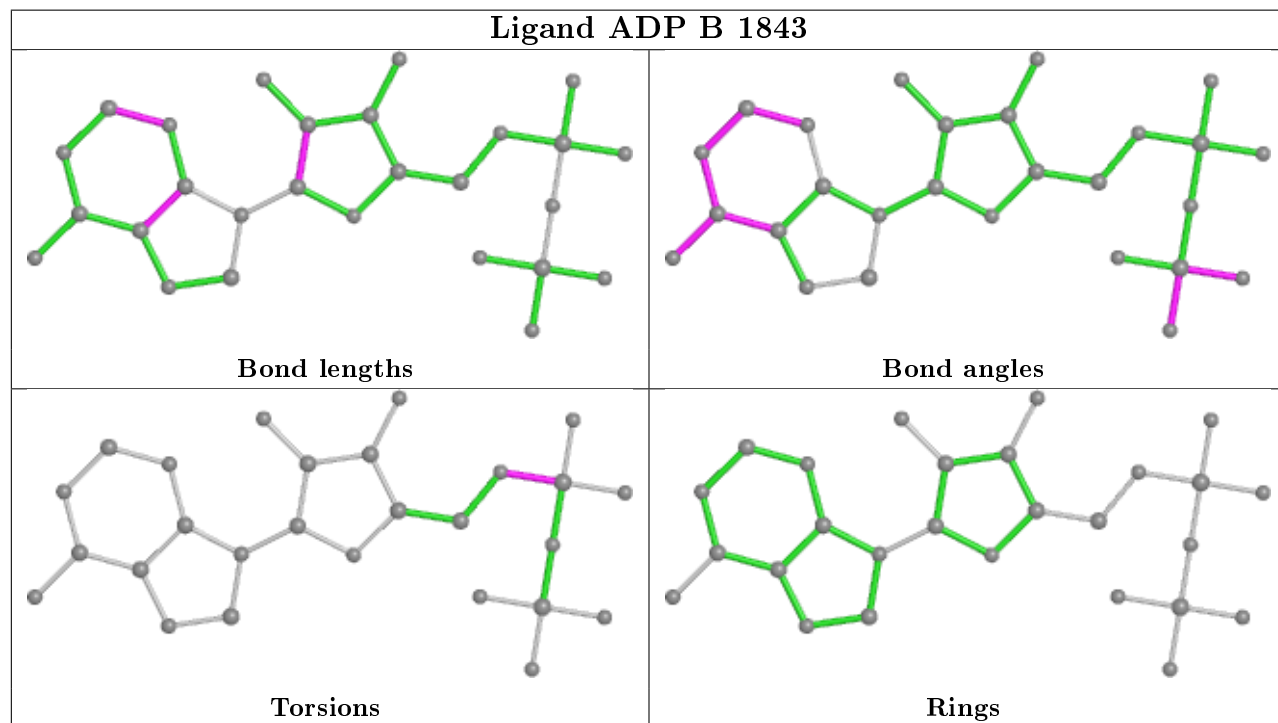
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1844	ADP	3	0
2	B	1843	ADP	6	0
2	B	1844	ADP	4	0
2	A	1843	ADP	2	0

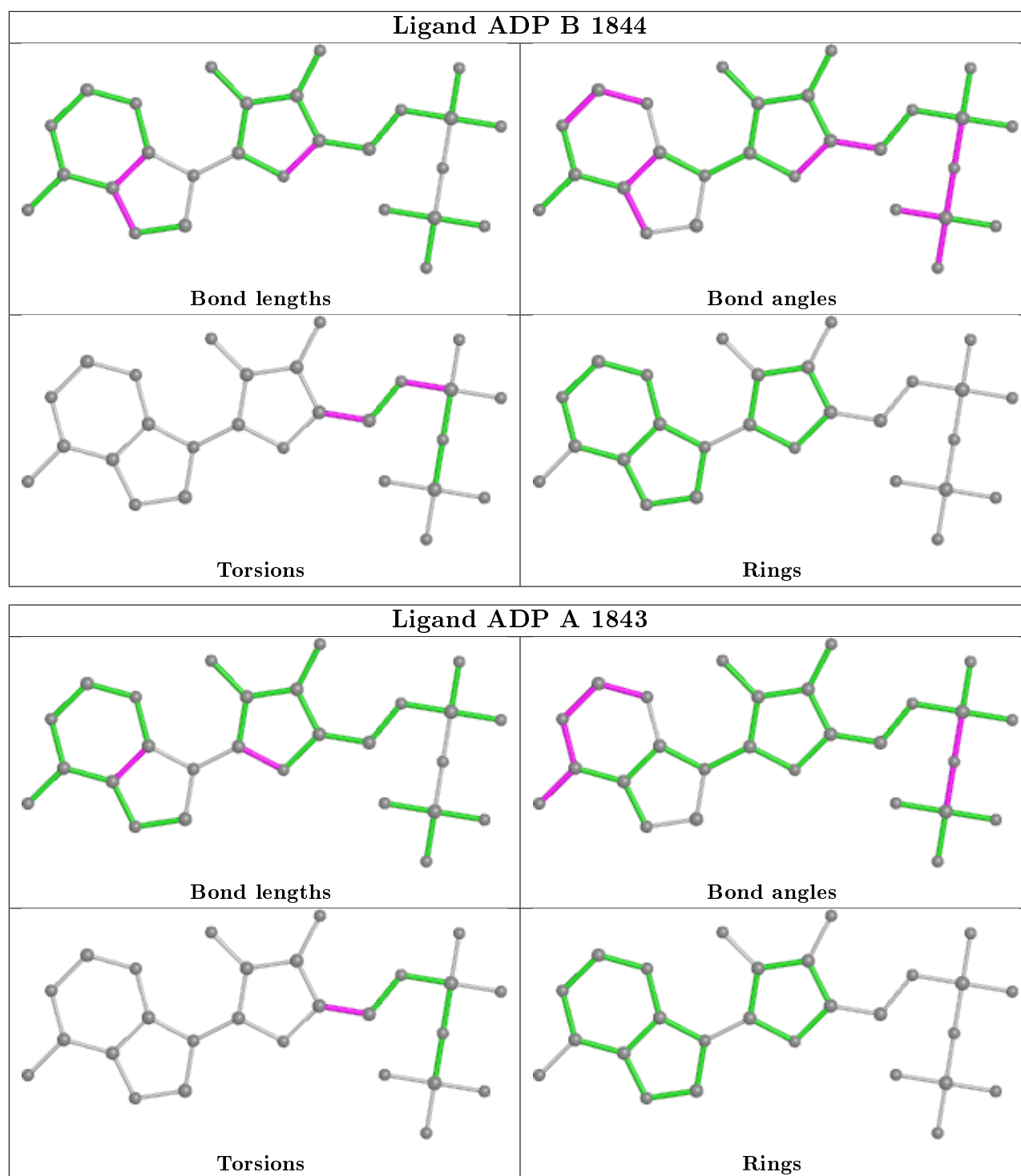
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

Ligand ADP A 1844



Ligand ADP B 1843





5.7 Other polymers [i](#)

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(Å ²)	Q<0.9
1	A	806/842 (95%)	-0.23	2 (0%) 95 87	38, 64, 92, 111	4 (0%)
1	B	835/842 (99%)	0.06	28 (3%) 45 19	40, 64, 97, 134	4 (0%)
All	All	1641/1684 (97%)	-0.09	30 (1%) 68 40	38, 64, 95, 134	8 (0%)

The worst 5 of 30 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	208	TRP	4.1
1	B	180	ALA	3.9
1	B	206	VAL	3.4
1	B	253	GLY	3.2
1	B	241[A]	ARG	3.2

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 carbohydrates in this entry.

6.4 Ligands [i](#)

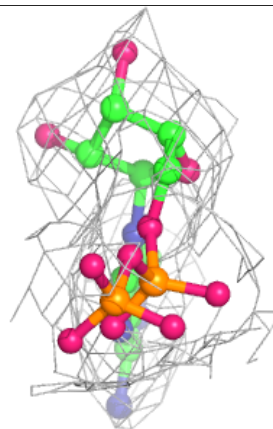
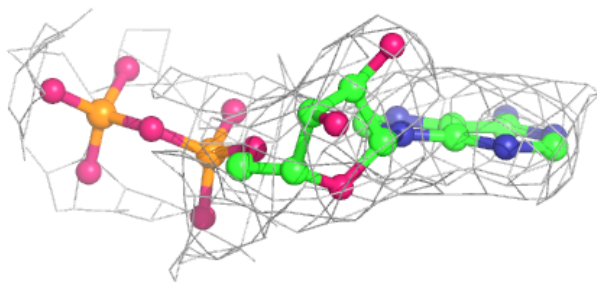
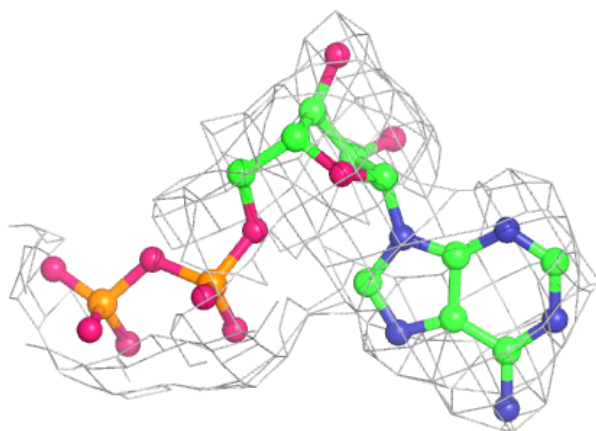
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	SO4	A	1849[A]	5/5	0.73	0.38	89,90,90,91	5
4	SO4	B	1851[A]	5/5	0.76	0.31	98,98,100,100	5
4	SO4	A	1848[A]	5/5	0.86	0.14	93,93,94,95	5
5	PO4	B	1852[A]	5/5	0.89	0.27	85,86,86,86	5
4	SO4	B	1850[A]	5/5	0.90	0.17	80,81,82,82	5
4	SO4	B	1848[A]	5/5	0.92	0.19	95,95,95,95	5
4	SO4	B	1849	5/5	0.94	0.18	93,94,95,96	0
2	ADP	A	1843	27/27	0.94	0.23	67,71,77,77	0
4	SO4	A	1847[A]	5/5	0.94	0.18	87,88,88,88	5
2	ADP	B	1843	27/27	0.95	0.19	53,57,58,59	0
2	ADP	B	1844	27/27	0.97	0.17	49,55,57,59	0
2	ADP	A	1844	27/27	0.97	0.18	31,47,51,51	0
3	ZN	B	1846	1/1	0.97	0.13	87,87,87,87	1
3	ZN	B	1845	1/1	0.97	0.19	44,44,44,44	1
4	SO4	B	1847	5/5	0.98	0.26	90,91,91,91	0
3	ZN	A	1845	1/1	0.98	0.10	80,80,80,80	1
3	ZN	A	1846	1/1	0.98	0.08	106,106,106,106	1

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.

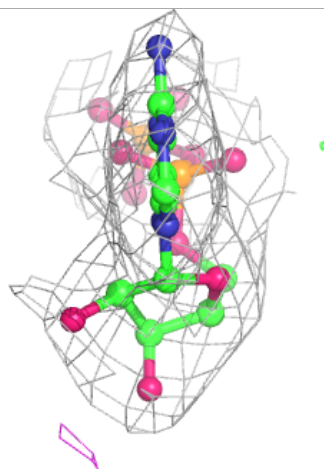
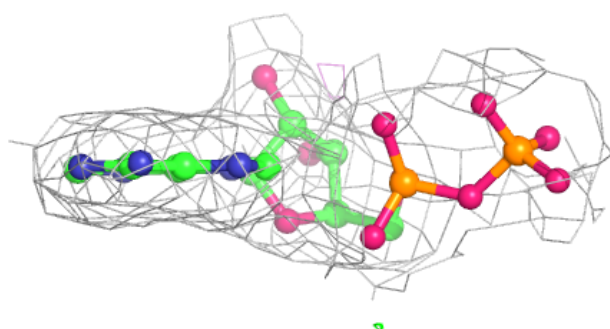
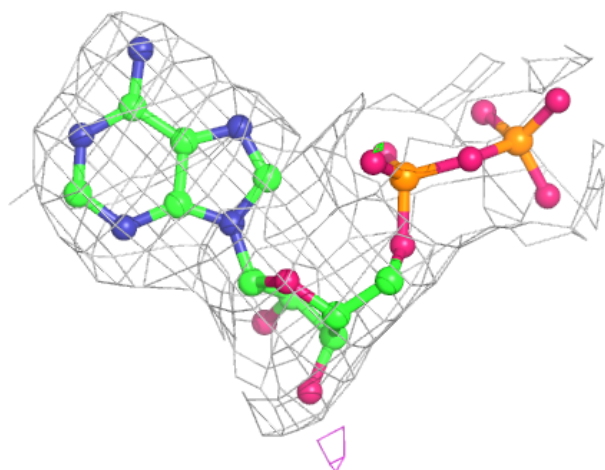
Electron density around ADP A 1843:

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



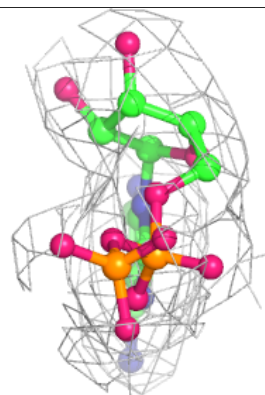
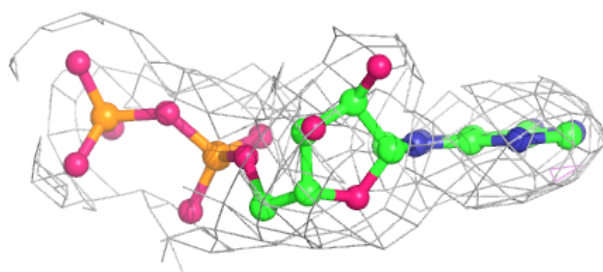
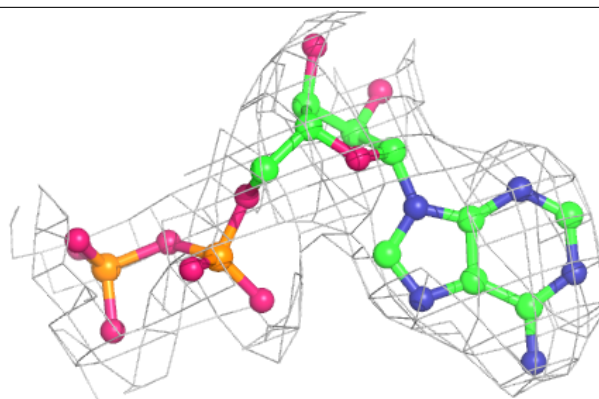
Electron density around ADP B 1843:

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

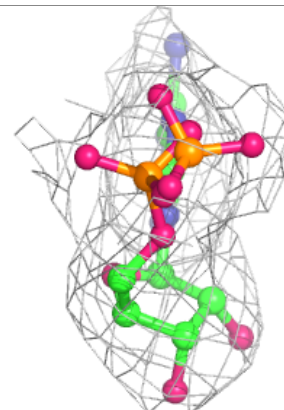
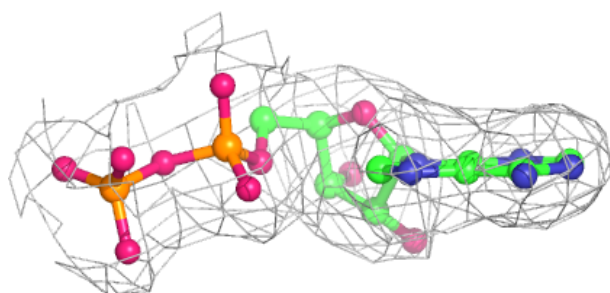
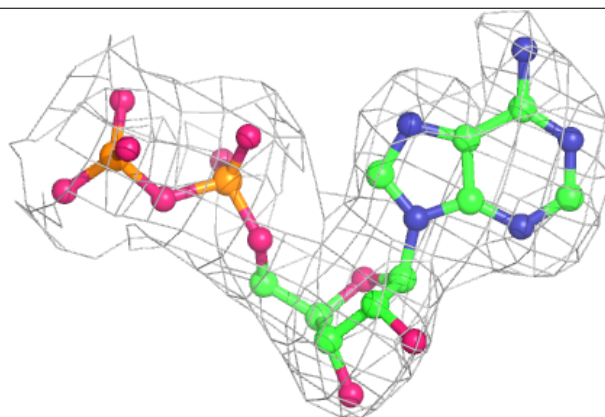


Electron density around ADP B 1844:

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

**Electron density around ADP A 1844:**

$2mF_o-DF_c$ (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.