wwPDB X-ray Structure Validation Summary Report ⓘ

Dec 8, 2023 – 02:58 am GMT

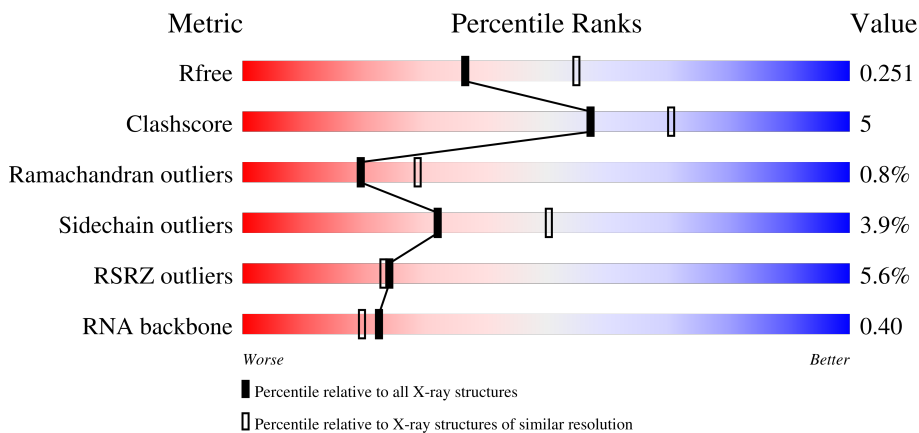|		
PDB ID	:	2JLY
Title	:	Dengue virus 4 NS3 helicase in complex with ssRNA and ADP-Phosphate
Authors	:	Luo, D.H.; Xu, T.; Watson, R.P.; Becker, D.S.; Sampath, A.; Jahnke, W.; Yeong, S.S.; Wang, C.H.; Lim, S.P.; Vasudevan, S.G.; Lescar, J.
Deposited on	:	2008-09-15
Resolution	:	2.40 Å(reported)

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 2.40 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		0.251
Clashscore		5
Ramachandran outliers		0.8%
Sidechain outliers		3.9%
RSRZ outliers		5.6%
RNA backbone		0.40

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	3907 (2.40-2.40)
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)
RSRZ outliers	127900	3811 (2.40-2.40)
RNA backbone	3102	1174 (2.80-2.00)

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	451	5% / 86% 12% ·
1	B	451	6% / 86% 13% ·
2	C	12	17% / 42% 17% 42%
2	D	12	17% / 50% 8% 42%

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	PO4	A	1620	-	-	X	-
4	PO4	B	1620	-	-	X	-

2 Entry composition ⓘ

There are 7 unique types of molecules in this entry. The entry contains 7942 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 SERINE PROTEASE SUBUNIT NS3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	451	Total	C	N	O	S	3	1	0
			3604	2271	641	675	17			
1	B	451	Total	C	N	O	S	0	0	0
			3584	2259	635	673	17			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	213	LEU	LYS	conflict	UNP Q2YHF0
A	250	ASP	GLU	conflict	UNP Q2YHF0
A	292	CYS	SER	conflict	UNP Q2YHF0
A	321	SER	THR	conflict	UNP Q2YHF0
A	381	ARG	LYS	conflict	UNP Q2YHF0
A	480	LYS	ARG	conflict	UNP Q2YHF0
B	213	LEU	LYS	conflict	UNP Q2YHF0
B	250	ASP	GLU	conflict	UNP Q2YHF0
B	292	CYS	SER	conflict	UNP Q2YHF0
B	321	SER	THR	conflict	UNP Q2YHF0
B	381	ARG	LYS	conflict	UNP Q2YHF0
B	480	LYS	ARG	conflict	UNP Q2YHF0

- Molecule 2 is a RNA chain called 5'-R(*AP*GP*AP*CP*UP*AP*AP*CP*AP*AP*CP*U) -3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	7	Total	C	N	O	P	0	0	0
			148	68	30	44	6			
2	D	7	Total	C	N	O	P	0	0	0
			148	68	30	44	6			

- Molecule 3 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$).

ADP

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

• Molecule 4 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).

PO4

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

- Molecule 5 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total 1	Mn 1	0	0
5	B	1	Total 1	Mn 1	0	0

- Molecule 6 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).
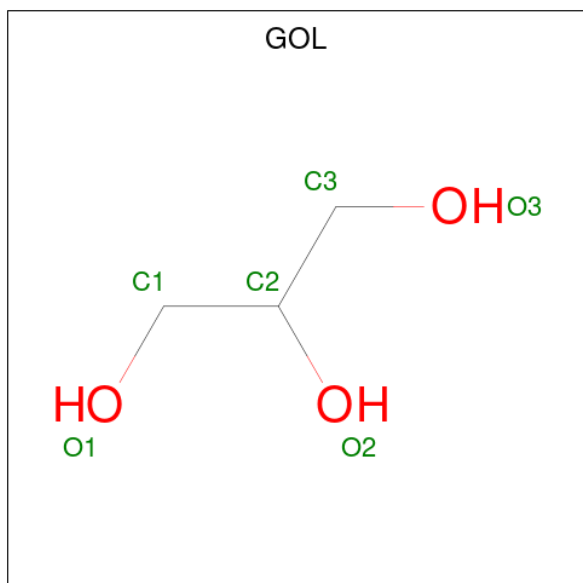
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total 6	C 3	O 3	0	0
6	B	1	Total 6	C 3	O 3	0	0

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	189	Total 189	O 189	0	0
7	B	182	Total 182	O 182	0	0
7	C	4	Total 4	O 4	0	0
7	D	5	Total 5	O 5	0	0

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.
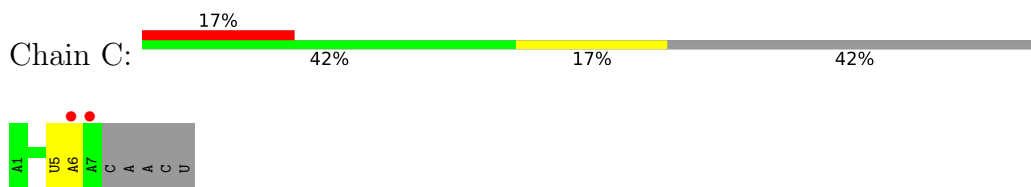
- Molecule 1: SERINE PROTEASE SUBUNIT NS3
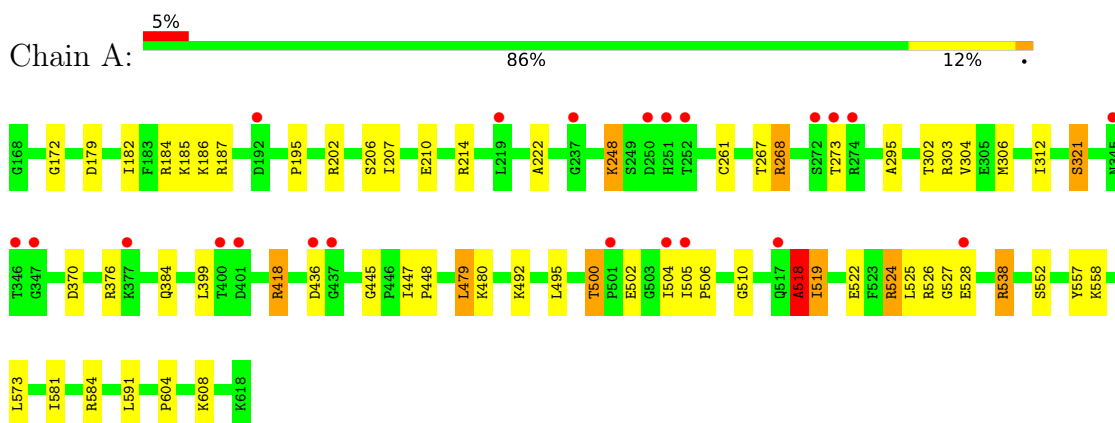
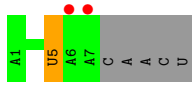- Molecule 1: SERINE PROTEASE SUBUNIT NS3
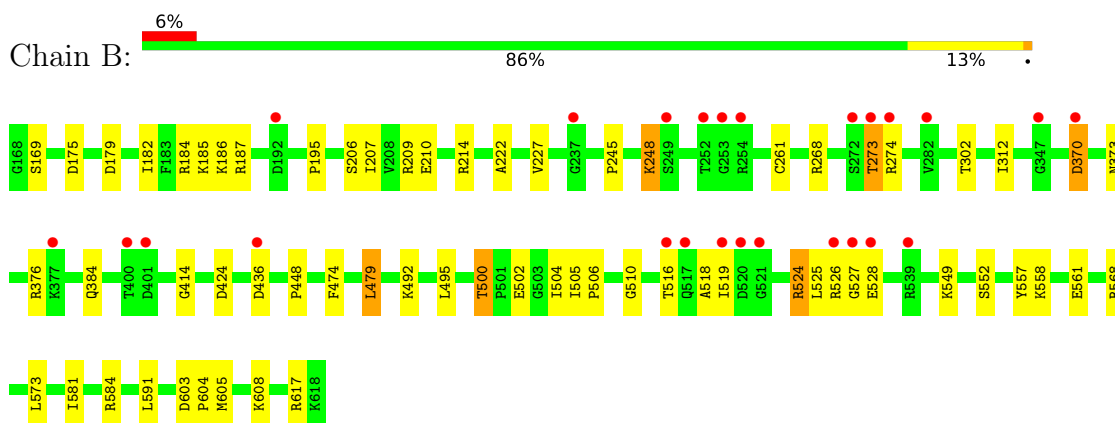
- Molecule 2: 5'-R(*AP*GP*AP*CP*UP*AP*AP*CP*AP*AP*CP*U)-3'

- Molecule 2: 5'-R(*AP*GP*AP*CP*UP*AP*AP*CP*AP*AP*CP*U)-3'

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	131.75Å 105.59Å 72.67Å 90.00° 117.68° 90.00°	Depositor
Resolution (Å)	19.99 – 2.40 19.89 – 2.40	Depositor EDS
% Data completeness (in resolution range)	99.6 (19.99-2.40) 99.6 (19.89-2.40)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.87 (at 2.41Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.199 , 0.255 0.198 , 0.251	Depositor DCC
R_{free} test set	1726 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	36.4	Xtriage
Anisotropy	0.034	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 50.1	EDS
L-test for twinning[2]	$< |L| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	7942	wwPDB-VP
Average B, all atoms (Å^2)	35.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.29% 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: PO4, ADP, MN, GOL

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	0.40	2/3688 (0.1%)	0.56	2/4994 (0.0%)
1	B	0.38	0/3665	0.56	2/4966 (0.0%)
2	C	0.68	0/166	1.09	0/257
2	D	0.64	0/166	1.08	1/257 (0.4%)
All	All	0.41	2/7685 (0.0%)	0.60	5/10474 (0.0%)

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	2
1	B	0	1
All	All	0	3

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	321[A]	SER	CA-C	5.12	1.66	1.52
1	A	321[B]	SER	CA-C	5.12	1.66	1.52

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	268	ARG	NE-CZ-NH1	-6.58	117.01	120.30
1	B	268	ARG	NE-CZ-NH2	6.52	123.56	120.30
1	A	268	ARG	NE-CZ-NH1	6.49	123.55	120.30
1	A	268	ARG	NE-CZ-NH2	-6.45	117.08	120.30
2	D	5	U	O4'-C1'-N1	6.04	113.03	108.20

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	273	THR	Peptide
1	A	518	ALA	Peptide
1	B	273	THR	Peptide

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	3604	0	3588	39	0
1	B	3584	0	3551	35	0
2	C	148	0	78	1	0
2	D	148	0	78	0	0
3	A	27	0	12	0	0
3	B	27	0	12	0	0
4	A	5	0	0	2	0
4	B	5	0	0	2	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
6	A	6	0	8	0	0
6	B	6	0	8	0	0
7	A	189	0	0	1	0
7	B	182	0	0	7	0
7	C	4	0	0	0	0
7	D	5	0	0	0	0
All	All	7942	0	7335	73	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 73 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:376:ARG:HH22	1:B:384:GLN:HE21	1.20	0.86
1:A:376:ARG:HH22	1:A:384:GLN:HE21	1.23	0.84

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:267:THR:HG23	1:A:538:ARG:HD3	1.62	0.80
4:B:1620:PO4:O4	7:B:2178:HOH:O	2.00	0.78
1:A:518:ALA:HB3	1:A:519:ILE:HA	1.70	0.72

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	450/451 (100%)	432 (96%)	15 (3%)	3 (1%)	22	32
1	B	449/451 (100%)	428 (95%)	17 (4%)	4 (1%)	17	25
All	All	899/902 (100%)	860 (96%)	32 (4%)	7 (1%)	19	29

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	518	ALA
1	B	518	ALA
1	B	519	ILE
1	A	527	GLY
1	B	527	GLY

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	388/388 (100%)	370 (95%)	18 (5%)	27	43
1	B	384/388 (99%)	371 (97%)	13 (3%)	37	56
All	All	772/776 (100%)	741 (96%)	31 (4%)	32	49

5 of 31 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	528	GLU
1	B	528	GLU
1	A	584	ARG
1	B	573	LEU
1	B	500	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	384	GLN
1	A	529	GLN
1	B	384	GLN
1	B	529	GLN

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	C	6/12 (50%)	1 (16%)	0
2	D	6/12 (50%)	0	1 (16%)
All	All	12/24 (50%)	1 (8%)	1 (8%)

All (1) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
2	C	5	U

All (1) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
2	D	5	U

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	ADP	B	1619	5	24,29,29	0.98	1 (4%)	29,45,45	1.30	3 (10%)
6	GOL	A	1622	-	5,5,5	0.41	0	5,5,5	0.23	0
6	GOL	B	1622	-	5,5,5	0.33	0	5,5,5	0.36	0
4	PO4	A	1620	-	4,4,4	1.04	0	6,6,6	0.73	0
3	ADP	A	1619	5	24,29,29	1.02	1 (4%)	29,45,45	1.22	3 (10%)
4	PO4	B	1620	-	4,4,4	1.11	0	6,6,6	0.47	0

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
6	GOL	A	1622	-	-	2/4/4/4	-
3	ADP	A	1619	5	-	1/12/32/32	0/3/3/3
3	ADP	B	1619	5	-	1/12/32/32	0/3/3/3
6	GOL	B	1622	-	-	2/4/4/4	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	1619	ADP	C5-C4	2.54	1.47	1.40
3	A	1619	ADP	C5-C4	2.45	1.47	1.40

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	1619	ADP	N3-C2-N1	-3.84	122.67	128.68
3	A	1619	ADP	N3-C2-N1	-3.57	123.11	128.68
3	B	1619	ADP	C4-C5-N7	-2.63	106.65	109.40
3	A	1619	ADP	C4-C5-N7	-2.42	106.87	109.40
3	B	1619	ADP	C2-N1-C6	2.12	122.38	118.75

There are no chirality outliers.
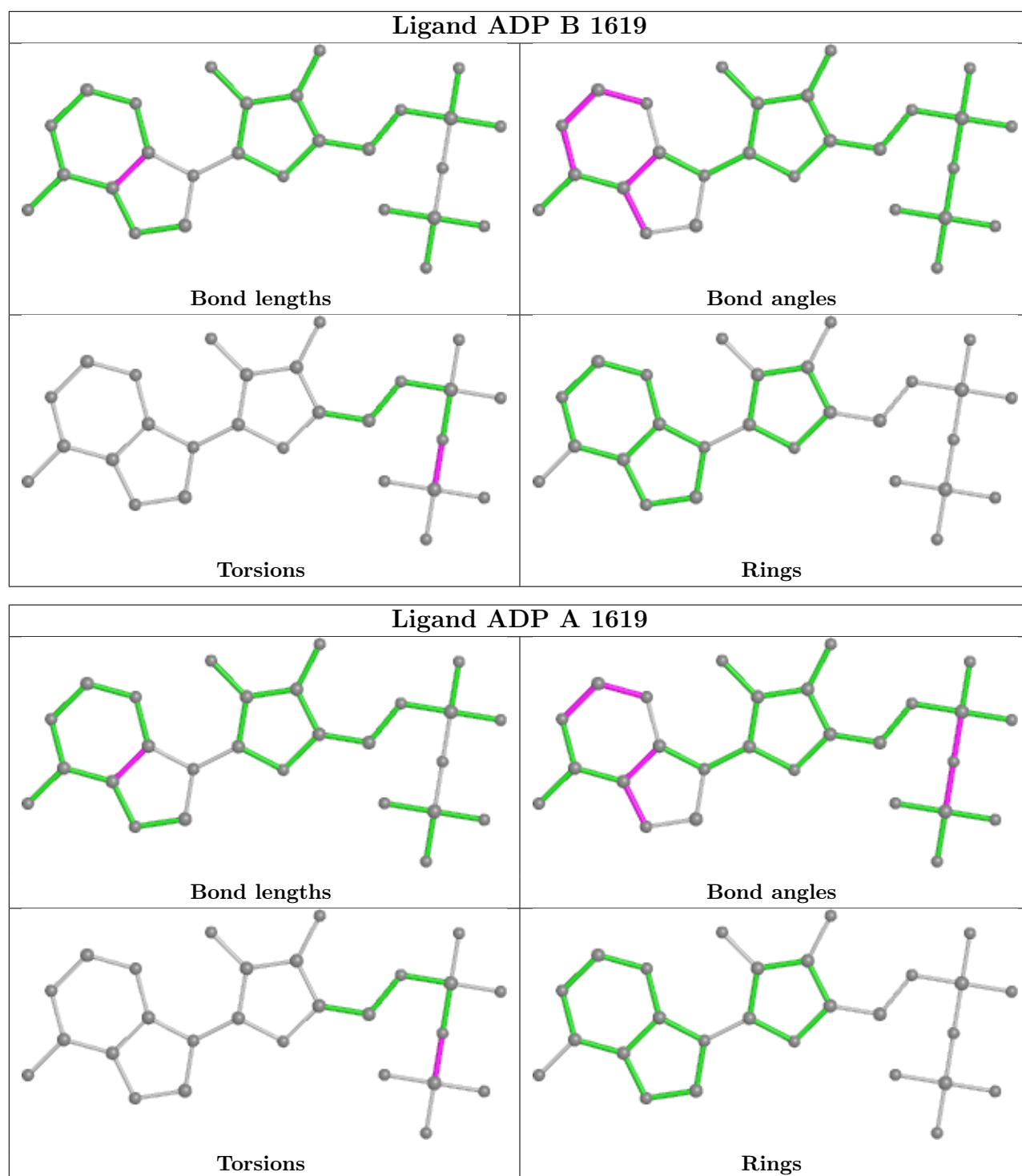
5 of 6 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1619	ADP	PA-O3A-PB-O3B
6	A	1622	GOL	C1-C2-C3-O3
6	B	1622	GOL	O1-C1-C2-C3
6	B	1622	GOL	O1-C1-C2-O2
6	A	1622	GOL	O2-C2-C3-O3

There are no ring outliers.

2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	1620	PO4	2	0
4	B	1620	PO4	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 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.

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PROTEIN DATA BANK

Ligand ADP B 1619

Bond lengths

Bond angles

Torsions

Rings

Ligand ADP A 1619

Bond lengths

Bond angles

Torsions

Rings

5.7   Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 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	451/451 (100%)	0.25	22 (4%)	29	28	26, 34, 45, 51	1 (0%)
1	B	451/451 (100%)	0.26	25 (5%)	25	24	26, 34, 45, 51	0
2	C	7/12 (58%)	0.74	2 (28%)	0	0	29, 32, 63, 74	0
2	D	7/12 (58%)	0.96	2 (28%)	0	0	29, 32, 70, 75	0
All	All	916/926 (98%)	0.27	51 (5%)	24	23	26, 35, 45, 75	1 (0%)

The worst 5 of 51 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	272	SER	9.3
1	B	273	THR	5.1
2	C	7	A	5.0
2	D	7	A	5.0
1	A	345	ASN	4.6

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

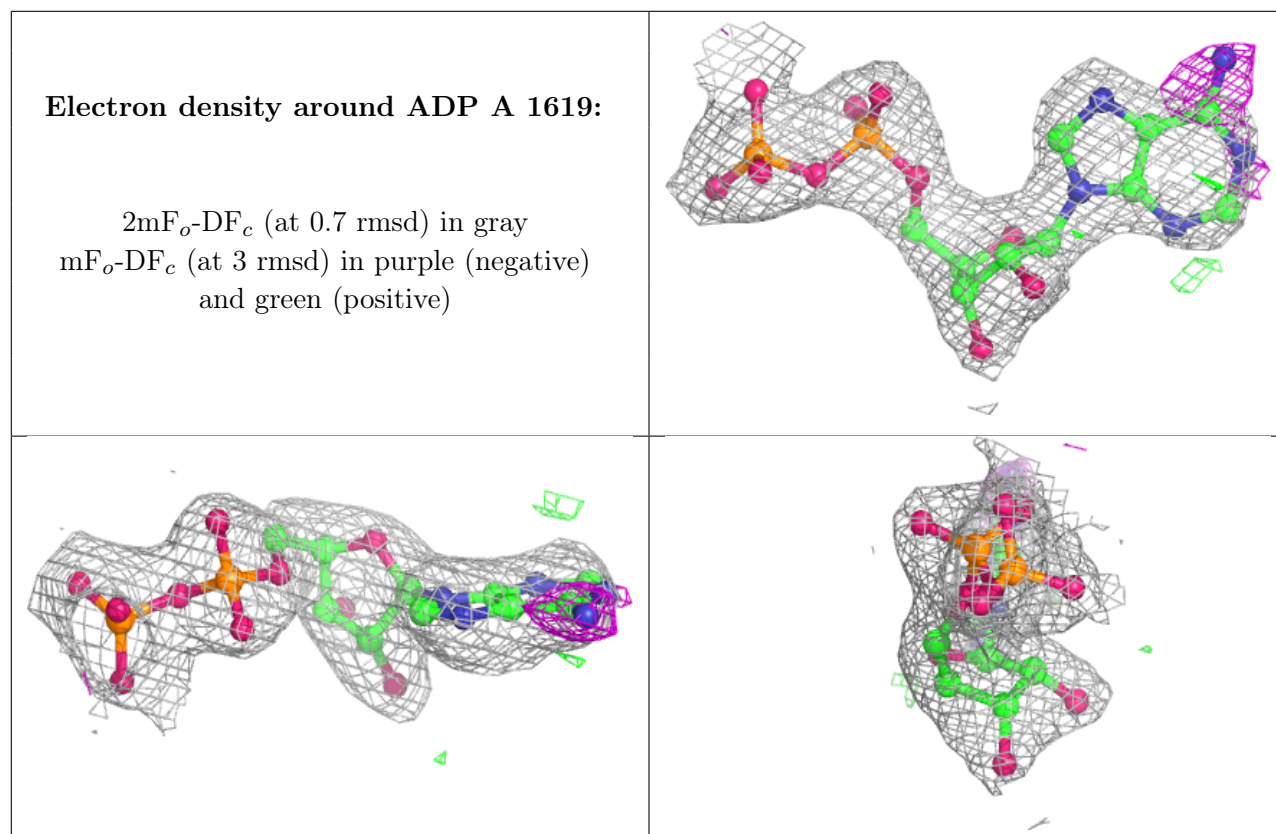There are no non-standard protein/DNA/RNA residues in this entry.

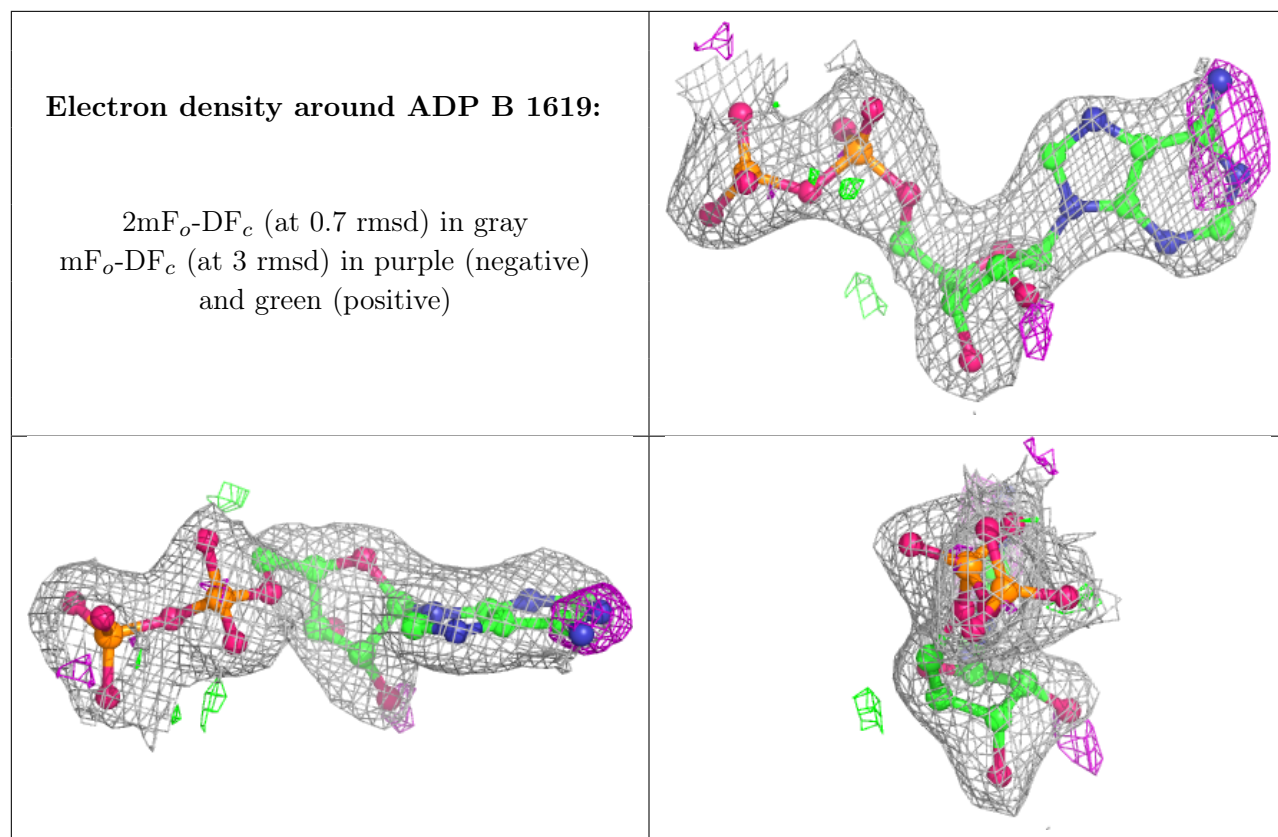## 6.3 Carbohydrates ⓘ

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.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
4	PO4	B	1620	5/5	0.89	0.28	47,47,48,48	5
4	PO4	A	1620	5/5	0.91	0.30	46,47,48,48	5
3	ADP	A	1619	27/27	0.93	0.15	30,37,41,41	0
6	GOL	B	1622	6/6	0.93	0.14	35,36,36,36	0
3	ADP	B	1619	27/27	0.94	0.15	28,32,37,37	0
6	GOL	A	1622	6/6	0.95	0.13	35,36,36,37	0
5	MN	A	1621	1/1	0.99	0.02	28,28,28,28	0
5	MN	B	1621	1/1	1.00	0.01	24,24,24,24	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 ADP A 1619:

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

Electron density around ADP B 1619:

$2\text{mF}_o\text{-DF}_c$ (at 0.7 rmsd) in gray
$\text{mF}_o\text{-DF}_c$ (at 3 rmsd) in purple (negative)
and green (positive)

6.5 Other polymers ⓘ

There are no such residues in this entry.