



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 06:40 PM UTC

PDB ID : 5EPV / pdb_00005epv
Title : Histidine kinase domain from the LOV-HK blue-light receptor from *Brucella abortus*
Authors : Rinaldi, J.; Guimaraes, B.G.; Legrand, P.; Thompson, A.; Paris, G.; Goldbaum, F.A.; Klinke, S.
Deposited on : 2015-11-12
Resolution : 2.51 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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 types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

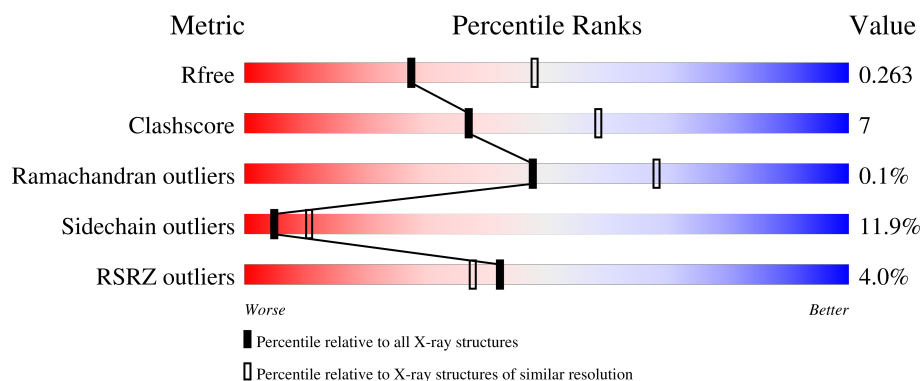
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.51 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	233	2% 75% 15% • • 7%
1	B	233	3% 67% 15% • 15%
1	C	233	55% 15% • 27%
1	D	233	8% 53% 15% • 29%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 5740 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 Blue-light-activated histidine kinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	216	Total	C	N	O	S	0	0	0
			1632	1030	293	300	9			
1	B	197	Total	C	N	O	S	0	0	0
			1483	940	265	269	9			
1	C	171	Total	C	N	O	S	0	0	0
			1266	811	216	231	8			
1	D	166	Total	C	N	O	S	0	0	0
			1233	788	211	228	6			

There are 36 discrepancies between the modelled and reference sequences:

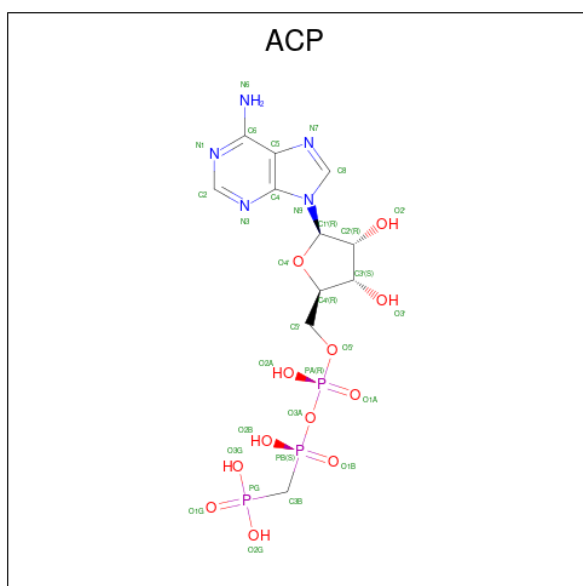
Chain	Residue	Modelled	Actual	Comment	Reference
A	263	MET	-	expression tag	UNP Q2YKK7
A	264	ALA	-	expression tag	UNP Q2YKK7
A	265	SER	-	expression tag	UNP Q2YKK7
A	490	HIS	-	expression tag	UNP Q2YKK7
A	491	HIS	-	expression tag	UNP Q2YKK7
A	492	HIS	-	expression tag	UNP Q2YKK7
A	493	HIS	-	expression tag	UNP Q2YKK7
A	494	HIS	-	expression tag	UNP Q2YKK7
A	495	HIS	-	expression tag	UNP Q2YKK7
B	263	MET	-	expression tag	UNP Q2YKK7
B	264	ALA	-	expression tag	UNP Q2YKK7
B	265	SER	-	expression tag	UNP Q2YKK7
B	490	HIS	-	expression tag	UNP Q2YKK7
B	491	HIS	-	expression tag	UNP Q2YKK7
B	492	HIS	-	expression tag	UNP Q2YKK7
B	493	HIS	-	expression tag	UNP Q2YKK7
B	494	HIS	-	expression tag	UNP Q2YKK7
B	495	HIS	-	expression tag	UNP Q2YKK7
C	263	MET	-	expression tag	UNP Q2YKK7
C	264	ALA	-	expression tag	UNP Q2YKK7
C	265	SER	-	expression tag	UNP Q2YKK7

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Chain	Residue	Modelled	Actual	Comment	Reference
C	490	HIS	-	expression tag	UNP Q2YKK7
C	491	HIS	-	expression tag	UNP Q2YKK7
C	492	HIS	-	expression tag	UNP Q2YKK7
C	493	HIS	-	expression tag	UNP Q2YKK7
C	494	HIS	-	expression tag	UNP Q2YKK7
C	495	HIS	-	expression tag	UNP Q2YKK7
D	263	MET	-	expression tag	UNP Q2YKK7
D	264	ALA	-	expression tag	UNP Q2YKK7
D	265	SER	-	expression tag	UNP Q2YKK7
D	490	HIS	-	expression tag	UNP Q2YKK7
D	491	HIS	-	expression tag	UNP Q2YKK7
D	492	HIS	-	expression tag	UNP Q2YKK7
D	493	HIS	-	expression tag	UNP Q2YKK7
D	494	HIS	-	expression tag	UNP Q2YKK7
D	495	HIS	-	expression tag	UNP Q2YKK7

- Molecule 2 is PHOSPHOMETHYLPHOSPHONIC ACID ADENYLATE ESTER (CCD ID: ACP) (formula: $C_{11}H_{18}N_5O_{12}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total 31	C 11	N 5	O 12	P 3	0	0
2	B	1	Total 31	C 11	N 5	O 12	P 3	0	0
2	C	1	Total 31	C 11	N 5	O 12	P 3	0	0

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	D	1	Total	C	N	O	P	0	0
			31	11	5	12	3		

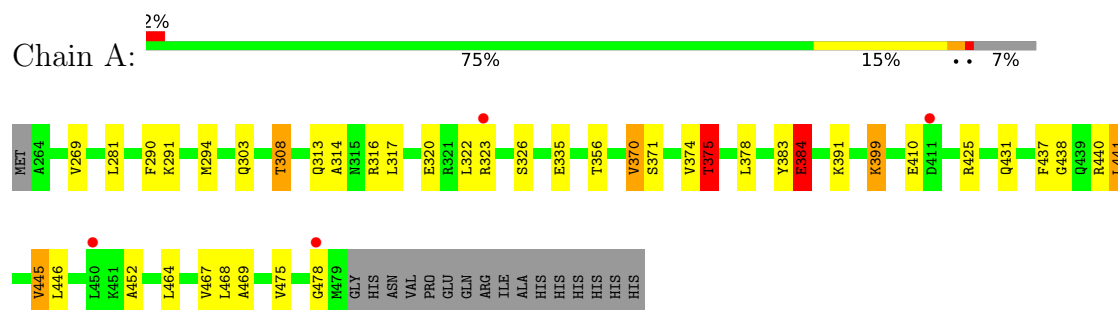
- Molecule 3 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Mg	0	0
			1	1		
3	B	1	Total	Mg	0	0
			1	1		

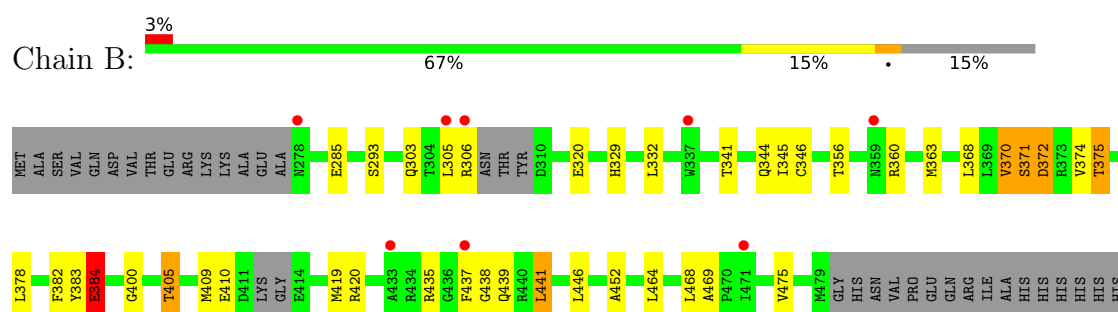
3 Residue-property plots

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.

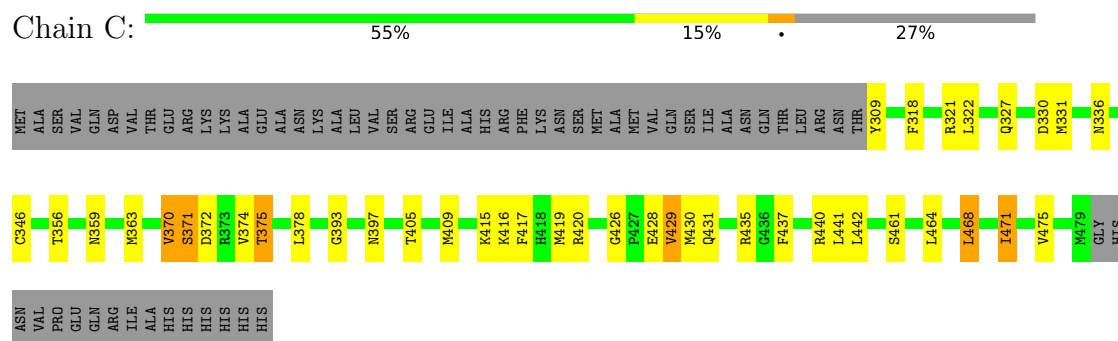
• Molecule 1: Blue-light-activated histidine kinase



• Molecule 1: Blue-light-activated histidine kinase

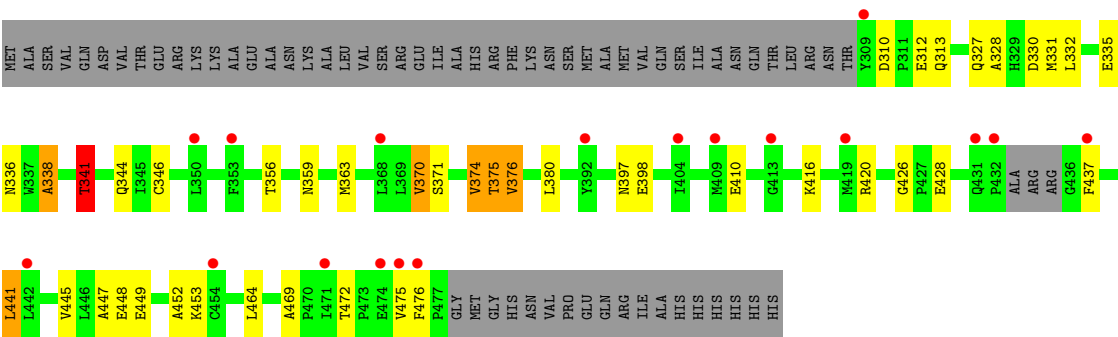


• Molecule 1: Blue-light-activated histidine kinase



• Molecule 1: Blue-light-activated histidine kinase





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	70.39Å 100.84Å 71.41Å 90.00° 102.75° 90.00°	Depositor
Resolution (Å)	48.55 – 2.51 48.55 – 2.51	Depositor EDS
% Data completeness (in resolution range)	98.1 (48.55-2.51) 98.1 (48.55-2.51)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	0.06	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.05 (at 2.51Å)	Xtriage
Refinement program	BUSTER 2.10.0	Depositor
R, R_{free}	0.202 , 0.242 0.216 , 0.263	Depositor DCC
R_{free} test set	1644 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	61.5	Xtriage
Anisotropy	0.449	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 48.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	0.029 for l,-k,h	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5740	wwPDB-VP
Average B, all atoms (Å ²)	74.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.64% 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: ACP, MG

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	0.92	0/1663	1.47	14/2258 (0.6%)
1	B	0.86	0/1511	1.39	6/2050 (0.3%)
1	C	0.86	0/1295	1.44	7/1766 (0.4%)
1	D	0.83	0/1261	1.45	5/1719 (0.3%)
All	All	0.87	0/5730	1.44	32/7793 (0.4%)

There are no bond length outliers.

All (32) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	445	VAL	N-CA-CB	8.35	118.48	111.64
1	A	269	VAL	N-CA-CB	-7.86	101.94	112.16
1	A	308	THR	CA-C-N	7.76	131.01	120.38
1	A	308	THR	C-N-CA	7.76	131.01	120.38
1	D	338	ALA	N-CA-C	-7.76	100.53	110.53
1	A	445	VAL	CB-CA-C	7.01	117.29	111.05
1	A	478	GLY	CA-C-N	6.41	133.24	121.70
1	A	478	GLY	C-N-CA	6.41	133.24	121.70
1	D	341	THR	CB-CA-C	6.34	120.13	109.48
1	C	429	VAL	CB-CA-C	6.12	120.20	111.81
1	C	372	ASP	CA-CB-CG	6.02	118.62	112.60
1	B	371	SER	CA-C-N	5.99	128.58	120.38
1	B	371	SER	C-N-CA	5.99	128.58	120.38
1	C	429	VAL	N-CA-CB	5.97	118.77	111.60
1	A	335	GLU	CA-C-N	-5.56	114.33	122.06
1	A	335	GLU	C-N-CA	-5.56	114.33	122.06
1	C	336	ASN	N-CA-C	5.47	118.75	112.57
1	D	447	ALA	N-CA-C	-5.42	105.02	111.03
1	A	281	LEU	CA-C-N	5.38	127.83	120.46
1	A	281	LEU	C-N-CA	5.38	127.83	120.46

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	376	VAL	N-CA-CB	5.34	117.41	110.57
1	C	371	SER	CA-C-N	5.32	127.73	120.54
1	C	371	SER	C-N-CA	5.32	127.73	120.54
1	A	269	VAL	CB-CA-C	5.25	118.05	111.65
1	B	372	ASP	CA-CB-CG	5.24	117.84	112.60
1	A	375	THR	N-CA-CB	5.23	117.81	110.12
1	B	384	GLU	CB-CG-CD	5.20	121.44	112.60
1	D	449	GLU	CB-CG-CD	5.13	121.33	112.60
1	A	384	GLU	CB-CG-CD	5.06	121.20	112.60
1	C	393	GLY	N-CA-C	5.02	118.86	112.13
1	B	329	HIS	CA-C-N	5.01	126.99	120.28
1	B	329	HIS	C-N-CA	5.01	126.99	120.28

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	1632	0	1597	20	0
1	B	1483	0	1443	21	0
1	C	1266	0	1213	23	0
1	D	1233	0	1165	24	0
2	A	31	0	14	0	0
2	B	31	0	14	1	0
2	C	31	0	14	0	0
2	D	31	0	14	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
All	All	5740	0	5474	80	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 7.

All (80) 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:303:GLN:HE22	1:A:440:ARG:HD2	1.21	1.01
1:D:371:SER:O	1:D:375:THR:HG23	1.76	0.84
1:B:384:GLU:HG3	1:B:438:GLY:HA2	1.66	0.78
1:D:341:THR:HG22	1:D:344:GLN:H	1.49	0.75
1:C:322:LEU:HD11	1:D:441:LEU:HD12	1.73	0.70
1:A:303:GLN:HG2	1:A:437:PHE:HD1	1.60	0.67
1:C:371:SER:O	1:C:375:THR:HG23	1.95	0.67
1:C:437:PHE:HA	1:C:440:ARG:NH1	2.12	0.65
1:A:384:GLU:HG3	1:A:438:GLY:HA2	1.79	0.65
1:C:374:VAL:HG21	1:C:475:VAL:HG13	1.78	0.64
1:A:320:GLU:HB3	1:A:383:TYR:OH	1.97	0.64
1:C:441:LEU:HD21	1:D:441:LEU:HD11	1.80	0.63
1:A:303:GLN:NE2	1:A:440:ARG:HD2	2.05	0.62
1:C:416:LYS:HD3	1:C:468:LEU:HD12	1.80	0.62
1:B:382:PHE:HZ	1:B:419:MET:HE1	1.66	0.61
1:C:397:ASN:HD21	1:C:426:GLY:HA2	1.66	0.61
1:D:397:ASN:HD21	1:D:426:GLY:HA2	1.64	0.61
1:C:321:ARG:HH11	1:D:328:ALA:HB2	1.67	0.60
1:D:370:VAL:HG12	1:D:375:THR:HG22	1.85	0.59
1:B:452:ALA:HB2	1:B:469:ALA:HB2	1.86	0.58
1:C:370:VAL:HG12	1:C:375:THR:HG22	1.87	0.57
1:D:341:THR:H	1:D:344:GLN:HG2	1.69	0.57
1:D:310:ASP:OD2	1:D:313:GLN:HG2	2.05	0.57
1:B:370:VAL:HG13	1:B:374:VAL:HB	1.87	0.56
1:B:360:ARG:HD2	1:B:400:GLY:O	2.05	0.56
1:A:452:ALA:HB2	1:A:469:ALA:HB2	1.88	0.56
1:B:346:CYS:HB3	1:B:363:MET:HE3	1.88	0.56
1:A:290:PHE:O	1:A:294:MET:HG2	2.06	0.55
1:B:341:THR:H	1:B:344:GLN:HE21	1.54	0.55
1:D:452:ALA:HB2	1:D:469:ALA:HB2	1.89	0.55
1:A:313:GLN:HE22	1:A:391:LYS:HD3	1.72	0.54
1:C:318:PHE:CE2	1:D:380:LEU:HD13	2.44	0.52
1:C:435:ARG:O	1:C:440:ARG:NH2	2.42	0.52
1:D:472:THR:OG1	1:D:475:VAL:HG22	2.10	0.51
1:A:374:VAL:HG21	1:A:475:VAL:HG13	1.92	0.51
1:D:475:VAL:HG23	1:D:476:PHE:CD2	2.46	0.51
1:A:371:SER:O	1:A:375:THR:HG23	2.11	0.51
1:A:399:LYS:HZ2	1:A:425:ARG:HB3	1.76	0.50
1:C:346:CYS:HB3	1:C:363:MET:HE3	1.92	0.50
1:C:309:TYR:CE1	1:D:335:GLU:HG3	2.47	0.50
1:C:371:SER:O	1:C:375:THR:CG2	2.58	0.50
1:A:370:VAL:HG13	1:A:374:VAL:HB	1.93	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:336:ASN:O	1:D:338:ALA:O	2.30	0.49
1:C:378:LEU:HD11	1:C:419:MET:HE1	1.93	0.49
1:D:346:CYS:HB3	1:D:363:MET:HE3	1.95	0.49
1:A:313:GLN:HG2	1:A:316:ARG:HH21	1.76	0.49
1:B:320:GLU:HB3	1:B:383:TYR:OH	2.12	0.49
1:A:320:GLU:HB3	1:A:383:TYR:CZ	2.48	0.49
1:C:309:TYR:CD1	1:D:335:GLU:HG3	2.48	0.48
1:A:303:GLN:HG2	1:A:437:PHE:CD1	2.47	0.47
1:A:378:LEU:HD13	1:A:446:LEU:HD11	1.97	0.47
1:B:374:VAL:HG21	1:B:475:VAL:HG13	1.96	0.47
1:B:405:THR:HG22	1:B:420:ARG:HB2	1.96	0.47
1:D:370:VAL:HG13	1:D:374:VAL:HG22	1.97	0.47
1:B:345:ILE:HG21	1:B:378:LEU:HB3	1.96	0.47
1:B:378:LEU:HD13	1:B:446:LEU:HD11	1.98	0.45
1:A:437:PHE:O	1:A:441:LEU:HB2	2.17	0.45
1:B:371:SER:O	1:B:375:THR:HG23	2.17	0.45
1:C:417:PHE:HB2	1:C:471:ILE:HD11	1.99	0.44
1:C:397:ASN:ND2	1:C:426:GLY:HA2	2.30	0.44
1:C:405:THR:HG23	1:C:420:ARG:HB3	2.00	0.44
1:C:437:PHE:HA	1:C:440:ARG:HH12	1.83	0.44
1:A:290:PHE:CE1	1:B:293:SER:OG	2.69	0.43
1:B:303:GLN:HG2	1:B:437:PHE:HD1	1.81	0.43
1:B:341:THR:HA	1:B:368:LEU:O	2.18	0.43
1:D:397:ASN:ND2	1:D:426:GLY:HA2	2.29	0.43
1:D:332:LEU:O	1:D:336:ASN:ND2	2.34	0.42
1:C:370:VAL:CG1	1:C:375:THR:HG22	2.49	0.42
1:D:437:PHE:CZ	1:D:441:LEU:HD23	2.54	0.42
1:B:437:PHE:O	1:B:441:LEU:HB2	2.20	0.42
1:A:308:THR:HG21	1:A:314:ALA:HB2	2.02	0.41
1:D:371:SER:O	1:D:375:THR:CG2	2.60	0.41
1:B:384:GLU:HG2	1:B:437:PHE:CD2	2.56	0.41
1:B:439:GLN:HG2	2:B:501:ACP:O2A	2.21	0.41
1:B:332:LEU:HD21	1:B:372:ASP:HA	2.03	0.41
1:D:370:VAL:CG1	1:D:375:THR:HG22	2.50	0.41
1:B:382:PHE:HZ	1:B:419:MET:CE	2.32	0.41
1:A:323:ARG:HA	1:A:326:SER:OG	2.22	0.40
1:C:346:CYS:SG	1:C:363:MET:HG2	2.61	0.40
1:C:321:ARG:HH12	1:D:327:GLN:HE21	1.69	0.40

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	214/233 (92%)	205 (96%)	9 (4%)	0	100	100
1	B	191/233 (82%)	185 (97%)	6 (3%)	0	100	100
1	C	169/233 (72%)	162 (96%)	6 (4%)	1 (1%)	21	38
1	D	162/233 (70%)	153 (94%)	9 (6%)	0	100	100
All	All	736/932 (79%)	705 (96%)	30 (4%)	1 (0%)	48	68

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	431	GLN

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	164/192 (85%)	149 (91%)	15 (9%)	9	19
1	B	148/192 (77%)	134 (90%)	14 (10%)	8	17
1	C	124/192 (65%)	107 (86%)	17 (14%)	3	7
1	D	120/192 (62%)	100 (83%)	20 (17%)	2	4
All	All	556/768 (72%)	490 (88%)	66 (12%)	5	11

All (66) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	291	LYS
1	A	317	LEU
1	A	322	LEU
1	A	356	THR
1	A	370	VAL
1	A	375	THR
1	A	384	GLU
1	A	399	LYS
1	A	410	GLU
1	A	431	GLN
1	A	441	LEU
1	A	445	VAL
1	A	464	LEU
1	A	467	VAL
1	A	468	LEU
1	B	285	GLU
1	B	305	LEU
1	B	306	ARG
1	B	356	THR
1	B	370	VAL
1	B	375	THR
1	B	384	GLU
1	B	405	THR
1	B	409	MET
1	B	410	GLU
1	B	435	ARG
1	B	441	LEU
1	B	464	LEU
1	B	468	LEU
1	C	327	GLN
1	C	330	ASP
1	C	331	MET
1	C	356	THR
1	C	359	ASN
1	C	370	VAL
1	C	375	THR
1	C	409	MET
1	C	415	LYS
1	C	428	GLU
1	C	429	VAL
1	C	430	MET
1	C	442	LEU
1	C	461	SER

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Mol	Chain	Res	Type
1	C	464	LEU
1	C	468	LEU
1	C	471	ILE
1	D	312	GLU
1	D	330	ASP
1	D	331	MET
1	D	341	THR
1	D	356	THR
1	D	359	ASN
1	D	370	VAL
1	D	374	VAL
1	D	375	THR
1	D	376	VAL
1	D	398	GLU
1	D	410	GLU
1	D	416	LYS
1	D	420	ARG
1	D	428	GLU
1	D	441	LEU
1	D	445	VAL
1	D	448	GLU
1	D	453	LYS
1	D	464	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	292	ASN
1	A	302	ASN
1	A	303	GLN
1	A	313	GLN
1	A	336	ASN
1	B	292	ASN
1	B	329	HIS
1	B	344	GLN
1	B	354	ASN
1	B	367	HIS
1	C	327	GLN
1	C	344	GLN
1	C	367	HIS
1	C	397	ASN
1	D	315	ASN

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Mol	Chain	Res	Type
1	D	327	GLN
1	D	397	ASN

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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 6 ligands modelled in this entry, 2 are monoatomic - leaving 4 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
2	ACP	C	501	-	31,33,33	0.94	4 (12%)	47,52,52	0.97	3 (6%)
2	ACP	D	501	-	31,33,33	0.68	1 (3%)	47,52,52	1.06	3 (6%)
2	ACP	A	501	3	31,33,33	0.76	1 (3%)	47,52,52	0.95	3 (6%)
2	ACP	B	501	3	31,33,33	1.01	4 (12%)	47,52,52	0.81	2 (4%)

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	ACP	C	501	-	-	3/19/38/38	0/3/3/3
2	ACP	D	501	-	-	3/19/38/38	0/3/3/3
2	ACP	A	501	3	-	3/19/38/38	0/3/3/3
2	ACP	B	501	3	-	3/19/38/38	0/3/3/3

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	501	ACP	PB-O3A	3.16	1.61	1.58
2	C	501	ACP	PB-O3A	2.92	1.61	1.58
2	A	501	ACP	PA-O3A	-2.62	1.56	1.59
2	C	501	ACP	PG-O1G	2.53	1.55	1.50
2	B	501	ACP	PB-O3A	2.52	1.61	1.58
2	B	501	ACP	PG-O1G	2.51	1.55	1.50
2	B	501	ACP	PG-O3G	-2.41	1.49	1.55
2	B	501	ACP	PB-O2B	-2.25	1.50	1.56
2	C	501	ACP	PB-O1B	2.25	1.56	1.51
2	C	501	ACP	PG-O3G	-2.18	1.50	1.55

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	501	ACP	O2A-PA-O3A	4.05	118.22	107.27
2	A	501	ACP	O1B-PB-C3B	3.75	118.93	109.05
2	D	501	ACP	O5'-PA-O1A	-3.35	95.65	108.94
2	C	501	ACP	O2B-PB-C3B	3.08	119.48	106.73
2	A	501	ACP	O2A-PA-O3A	2.94	115.23	107.27
2	D	501	ACP	O1B-PB-C3B	2.64	116.01	109.05
2	C	501	ACP	O3A-PA-O1A	2.64	118.65	110.70
2	B	501	ACP	O2B-PB-C3B	2.53	117.22	106.73
2	C	501	ACP	O2A-PA-O5'	-2.53	96.12	107.57
2	B	501	ACP	O3G-PG-O2G	2.42	114.85	107.96
2	A	501	ACP	O1G-PG-C3B	-2.10	106.80	111.37

There are no chirality outliers.

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	501	ACP	PB-C3B-PG-O1G
2	A	501	ACP	PB-C3B-PG-O2G
2	A	501	ACP	PB-C3B-PG-O3G

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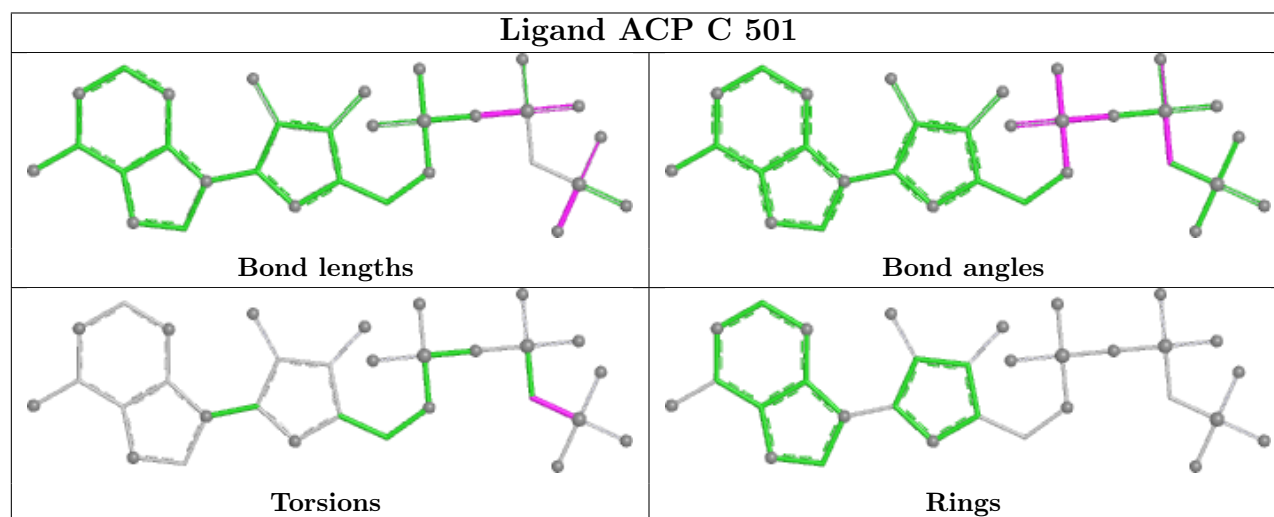
Mol	Chain	Res	Type	Atoms
2	B	501	ACP	PB-C3B-PG-O1G
2	B	501	ACP	PB-C3B-PG-O2G
2	B	501	ACP	PB-C3B-PG-O3G
2	C	501	ACP	PB-C3B-PG-O1G
2	C	501	ACP	PB-C3B-PG-O2G
2	C	501	ACP	PB-C3B-PG-O3G
2	D	501	ACP	PB-C3B-PG-O1G
2	D	501	ACP	PB-C3B-PG-O2G
2	D	501	ACP	PB-C3B-PG-O3G

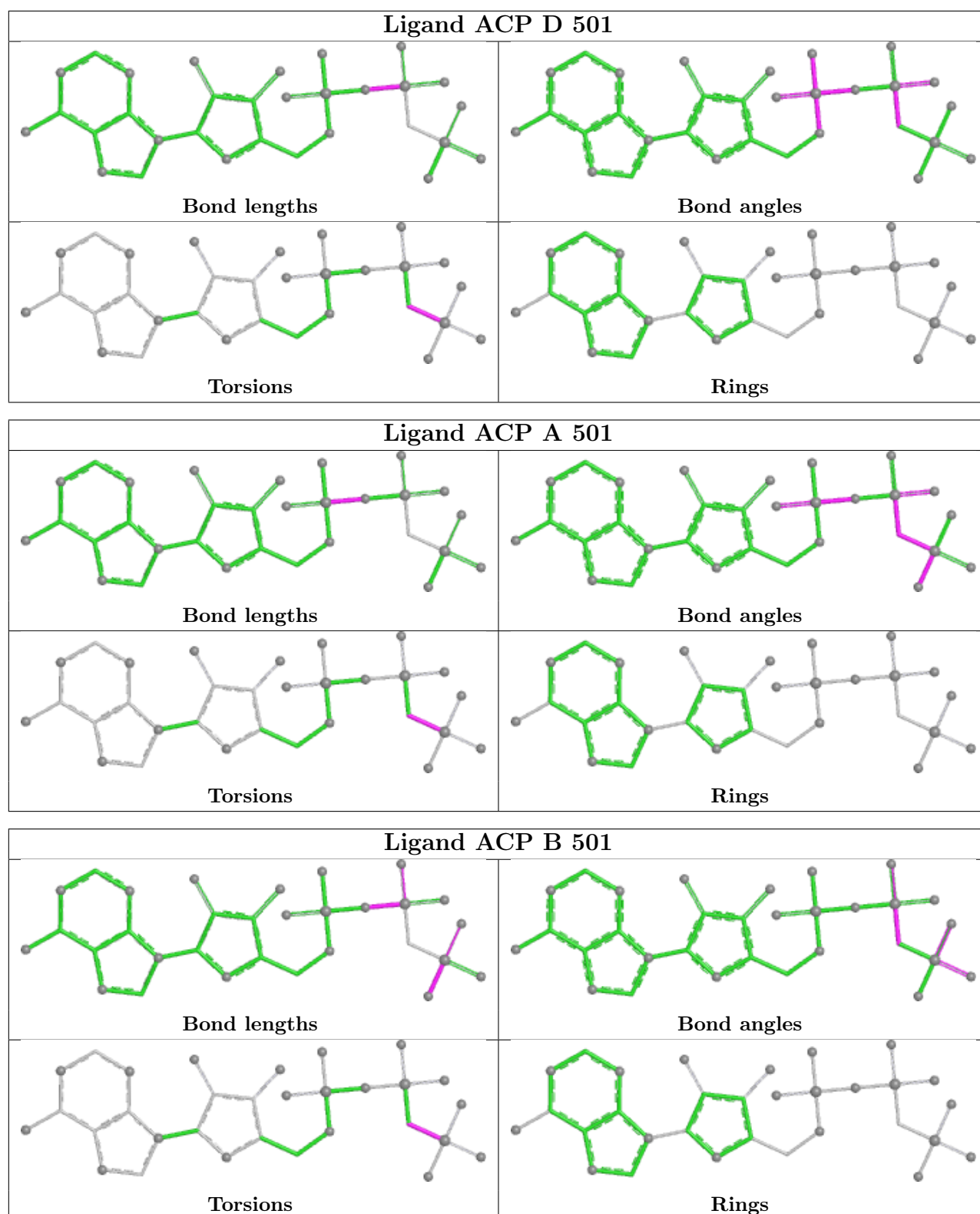
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	501	ACP	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





5.7 Other polymers ⓘ

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	216/233 (92%)	0.22	4 (1%) 66 62	43, 64, 92, 109	0
1	B	197/233 (84%)	0.44	8 (4%) 41 37	47, 71, 98, 119	0
1	C	171/233 (73%)	0.41	0 100 100	47, 70, 103, 118	0
1	D	166/233 (71%)	0.89	18 (10%) 11 9	49, 88, 111, 122	0
All	All	750/932 (80%)	0.47	30 (4%) 42 38	43, 71, 104, 122	0

All (30) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	475	VAL	4.3
1	D	350	LEU	4.2
1	D	432	PRO	3.3
1	D	431	GLN	3.2
1	D	309	TYR	3.1
1	A	478	GLY	3.0
1	D	471	ILE	3.0
1	D	476	PHE	3.0
1	B	337	TRP	2.8
1	B	437	PHE	2.7
1	D	409	MET	2.5
1	D	413	GLY	2.5
1	D	404	ILE	2.5
1	D	368	LEU	2.4
1	D	353	PHE	2.3
1	B	471	ILE	2.3
1	D	454	CYS	2.3
1	D	437	PHE	2.3
1	A	411	ASP	2.2
1	B	305	LEU	2.2
1	D	442	LEU	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	306	ARG	2.2
1	A	450	LEU	2.2
1	D	474	GLU	2.2
1	D	419	MET	2.1
1	B	278	ASN	2.1
1	B	433	ALA	2.1
1	D	392	TYR	2.0
1	A	323	ARG	2.0
1	B	359	ASN	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 oligosaccharides in this entry.

6.4 Ligands [i](#)

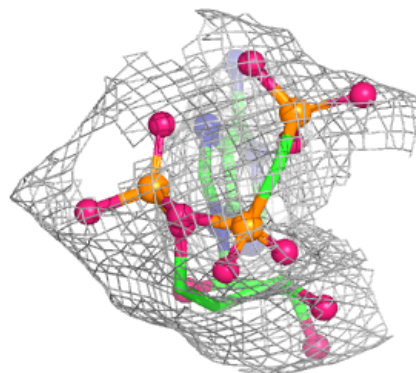
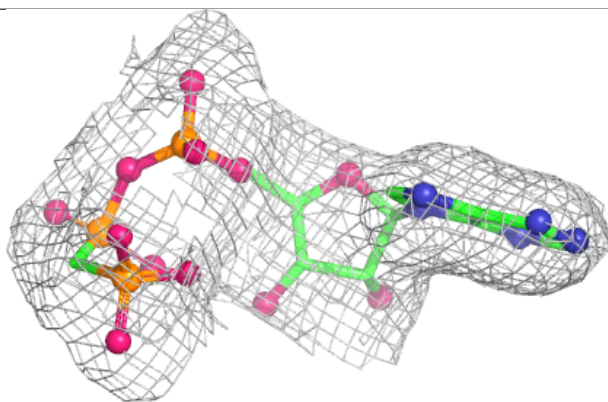
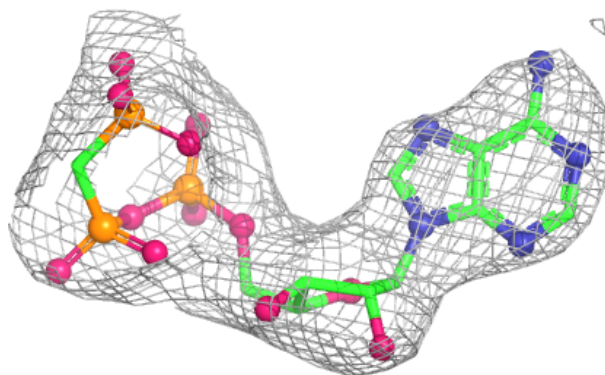
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	ACP	D	501	31/31	0.83	0.10	110,119,157,158	0
2	ACP	C	501	31/31	0.87	0.10	74,90,133,133	0
3	MG	A	502	1/1	0.94	0.07	50,50,50,50	0
2	ACP	B	501	31/31	0.95	0.07	47,63,68,71	0
2	ACP	A	501	31/31	0.97	0.06	43,49,54,59	0
3	MG	B	502	1/1	0.97	0.07	50,50,50,50	0

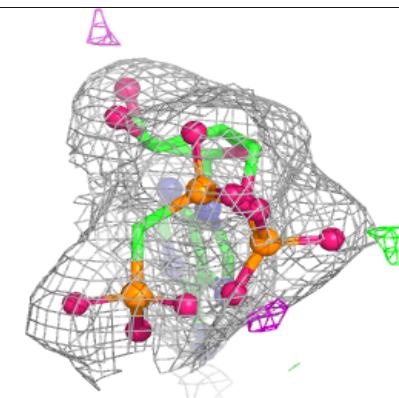
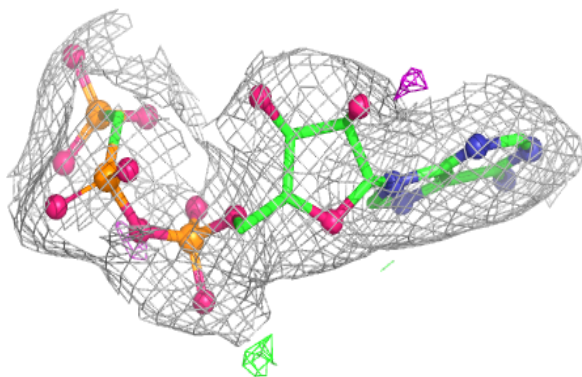
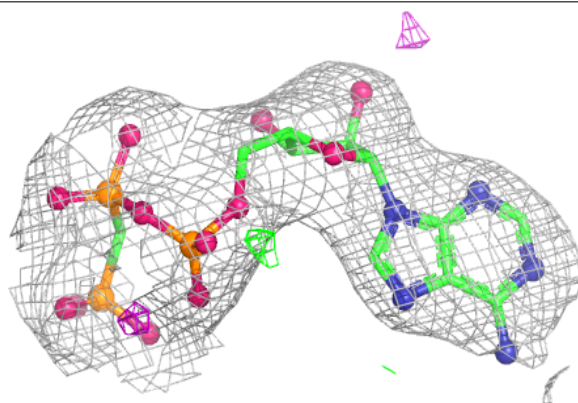
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around ACP D 501:

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

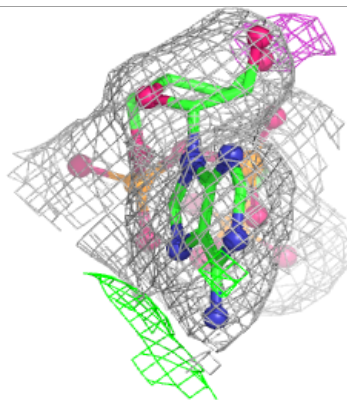
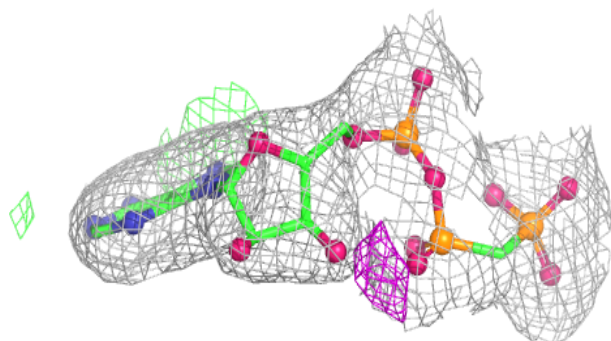
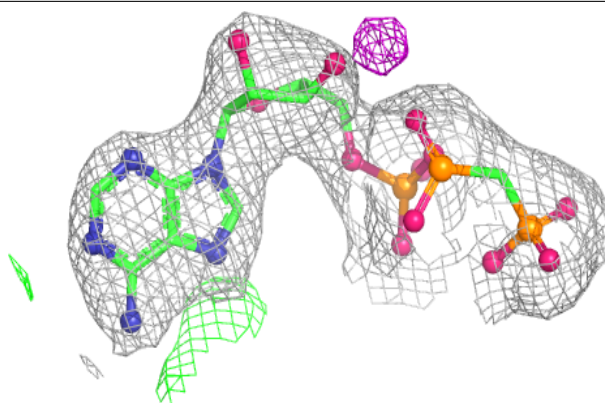
**Electron density around ACP C 501:**

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

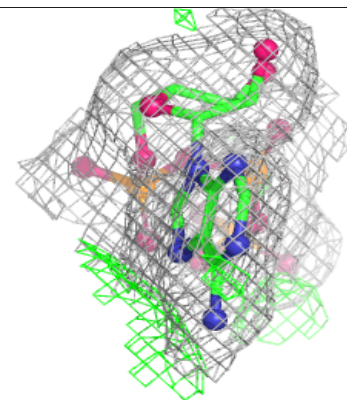
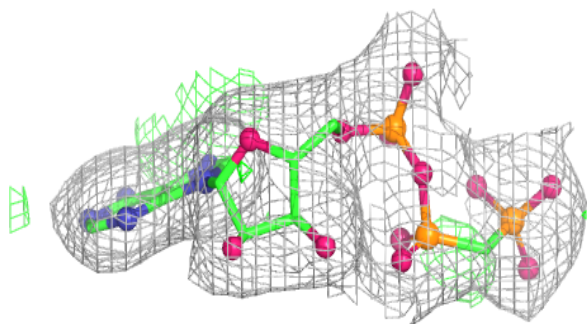
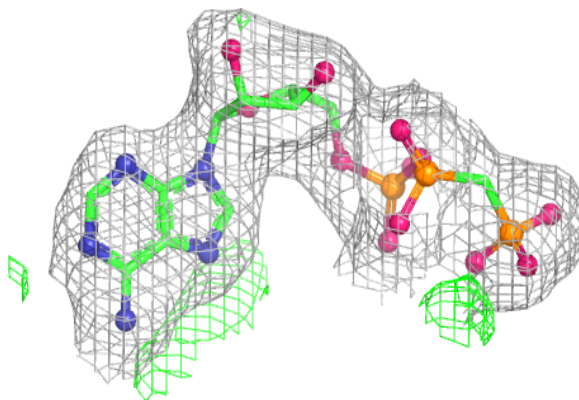


Electron density around ACP B 501:

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

**Electron density around ACP A 501:**

$2mF_o-DF_c$ (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.