



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 15, 2022 – 03:19 pm GMT

PDB ID : 7ZX2  
Title : Tubulin-Pelophen B complex  
Authors : Estevez-Gallego, J.; Diaz, J.F.; Van der Eycken, J.; Oliva, M.A.  
Deposited on : 2022-05-20  
Resolution : 2.50 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](mailto: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>.

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

MolProbity : 4.02b-467  
Mogul : 1.8.4, CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.31.2  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0267  
CCP4 : 7.1.010 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.31.2

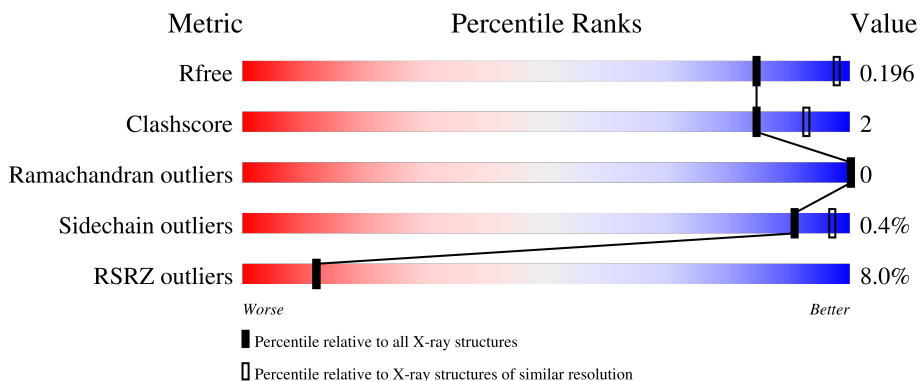
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 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))
$R_{free}$	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (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  $\geq 3$ , 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	451	 2% 89% 7%
1	C	451	 0% 90% 7%
2	B	445	 3% 89% 6% 5%
2	D	445	 7% 87% 8% 5%
3	E	189	 6% 61% 37%

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Mol	Chain	Length	Quality of chain
4	F	384	 <p>A horizontal bar chart representing the quality of chain. The bar is divided into three segments: a red segment on the left labeled '26%', a green segment in the middle labeled '66%', and a grey segment on the right labeled '30%'. A small yellow segment is visible at the end of the green segment, and a small black dot is visible at the end of the grey segment.</p>

## 2 Entry composition [i](#)

There are 15 unique types of molecules in this entry. The entry contains 17266 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 Tubulin alpha-1B chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	434	Total	C	N	O	S	0	7	0
			3439	2174	585	656	24			
1	C	439	Total	C	N	O	S	0	10	0
			3499	2211	593	670	25			

- Molecule 2 is a protein called Tubulin beta-2B chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	423	Total	C	N	O	S	0	6	0
			3375	2119	574	655	27			
2	D	421	Total	C	N	O	S	0	2	0
			3322	2088	564	642	28			

- Molecule 3 is a protein called Stathmin-4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	E	120	Total	C	N	O	S	0	3	0
			1019	628	185	201	5			

- Molecule 4 is a protein called Tubulin beta-2B chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	F	268	Total	C	N	O	S	0	0	0
			2216	1445	373	386	12			

There are 6 discrepancies between the modelled and reference sequences:

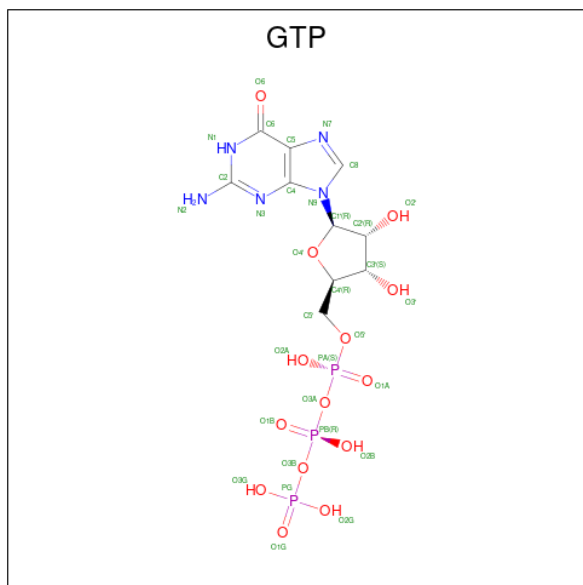
Chain	Residue	Modelled	Actual	Comment	Reference
F	379	HIS	-	expression tag	UNP E1BQ43
F	380	HIS	-	expression tag	UNP E1BQ43
F	381	HIS	-	expression tag	UNP E1BQ43
F	382	HIS	-	expression tag	UNP E1BQ43

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Chain	Residue	Modelled	Actual	Comment	Reference
F	383	HIS	-	expression tag	UNP E1BQ43
F	384	HIS	-	expression tag	UNP E1BQ43

- Molecule 5 is GUANOSINE-5'-TRIPHOSPHATE (three-letter code: GTP) (formula:  $C_{10}H_{16}N_5O_{14}P_3$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	N	O			P
5	A	1	32	10	5	14	3	0	0
5	C	1	32	10	5	14	3	0	0

- Molecule 6 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
6	A	1	1	1	0	0
6	B	1	1	1	0	0
6	C	1	1	1	0	0
6	D	1	1	1	0	0

- Molecule 7 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	1	Total C O 6 3 3	0	0
7	A	1	Total C O 6 3 3	0	0
7	A	1	Total C O 6 3 3	0	0
7	A	1	Total C O 6 3 3	0	0
7	A	1	Total C O 6 3 3	0	0
7	B	1	Total C O 6 3 3	0	0
7	C	1	Total C O 6 3 3	0	0
7	C	1	Total C O 6 3 3	0	0

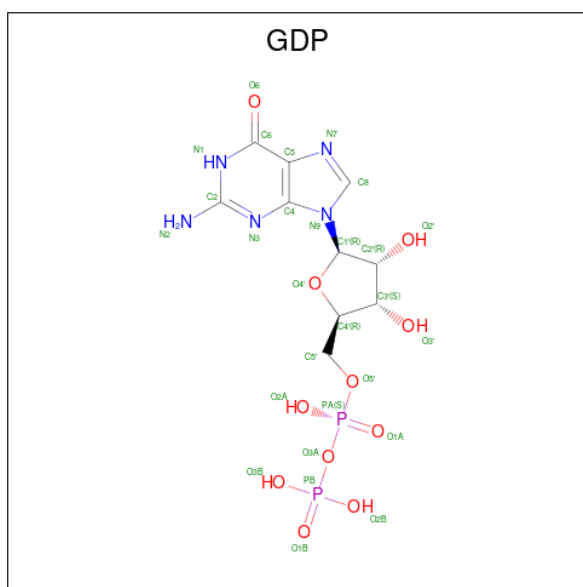
- Molecule 8 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	1	Total Cl 1 1	0	0

- Molecule 9 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	A	1	Total Ca 1 1	0	0
9	B	1	Total Ca 1 1	0	0
9	C	1	Total Ca 1 1	0	0

- Molecule 10 is GUANOSINE-5'-DIPHOSPHATE (three-letter code: GDP) (formula:  $C_{10}H_{15}N_5O_{11}P_2$ ).



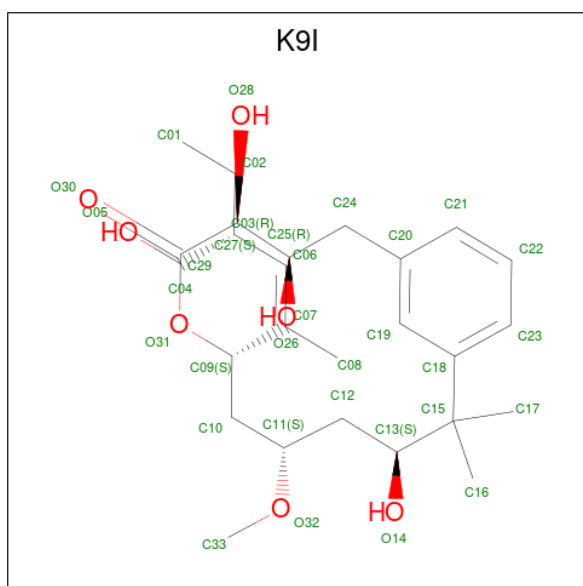
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	B	1	Total C N O P 28 10 5 11 2	0	0
10	D	1	Total C N O P 28 10 5 11 2	0	0

- Molecule 11 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (three-letter code: MES) (formula:  $C_6H_{13}NO_4S$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
11	B	1	12	6	1	4	1	0	0

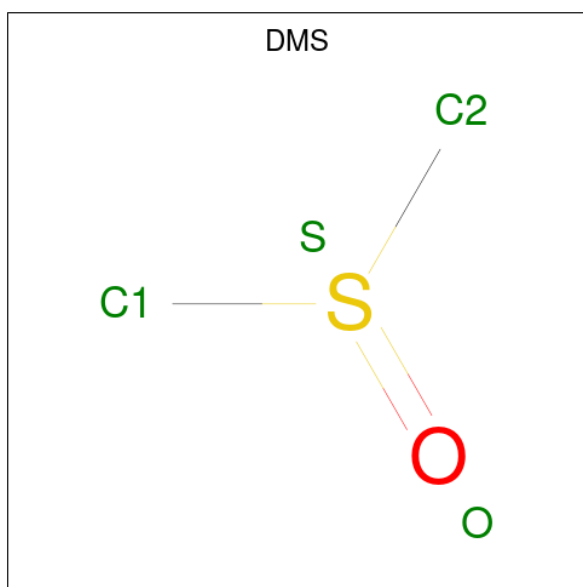
- Molecule 12 is (3R,4S,7S,9S,11S)-3,4,11-trihydroxy-7-((R,Z)-4-(hydroxymethyl)hex-2-en-2-yl)-9-methoxy-12,12-dimethyl-6-oxa-1(1,3)-benzenacyclododecaphan-5-one (three-letter code: K9I) (formula: C<sub>26</sub>H<sub>40</sub>O<sub>7</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
12	B	1	33	26	7	0	0

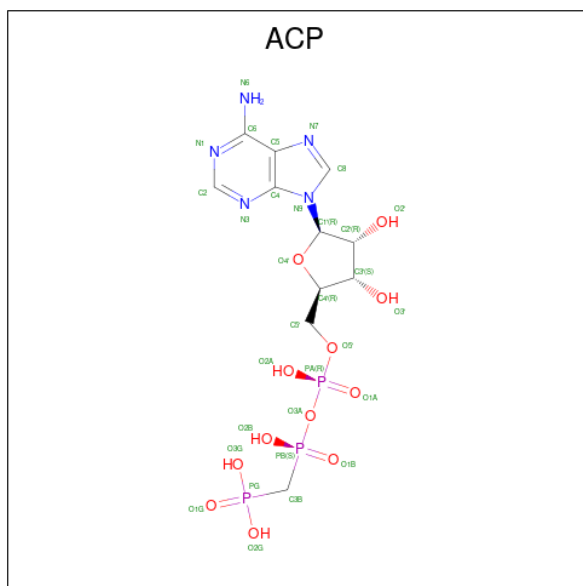
- Molecule 13 is DIMETHYL SULFOXIDE (three-letter code: DMS) (formula: C<sub>2</sub>H<sub>6</sub>OS).





Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	O	S		
13	C	1	4	2	1	1	0	0

- Molecule 14 is PHOSPHOMETHYLPHOSPHONIC ACID ADENYLATE ESTER (three-letter code: ACP) (formula:  $C_{11}H_{18}N_5O_{12}P_3$ ).



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

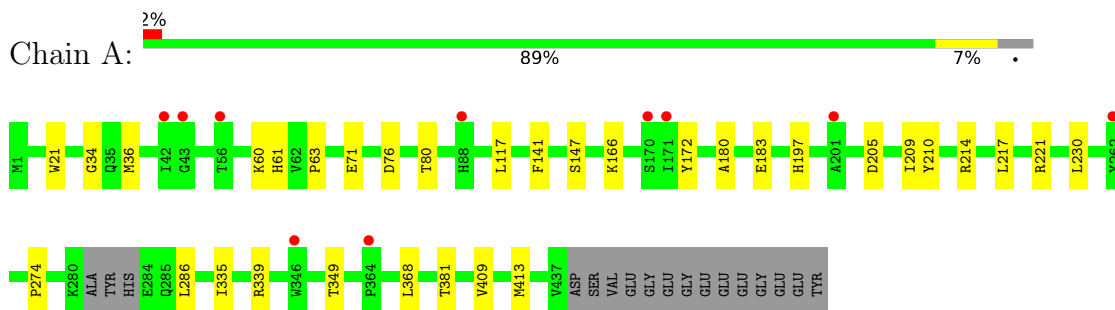
- Molecule 15 is water.

<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
15	A	18	Total 18	O 18	0	0
15	B	24	Total 24	O 24	0	0
15	C	86	Total 86	O 86	0	0
15	D	10	Total 10	O 10	0	0
15	F	2	Total 2	O 2	0	0

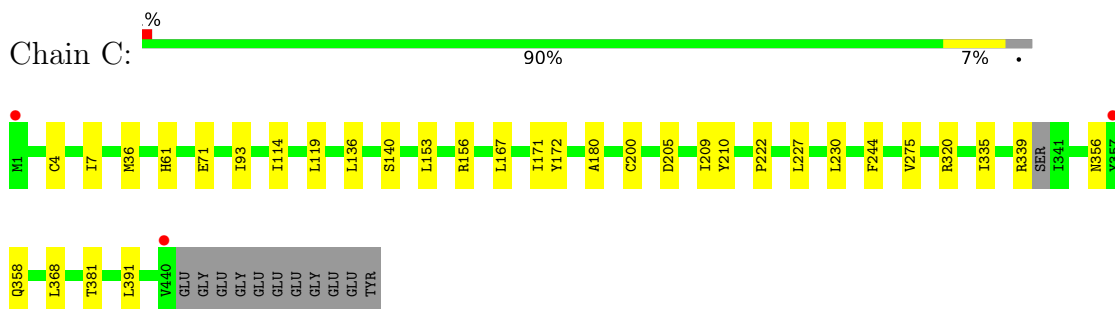
### 3 Residue-property plots [i](#)

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

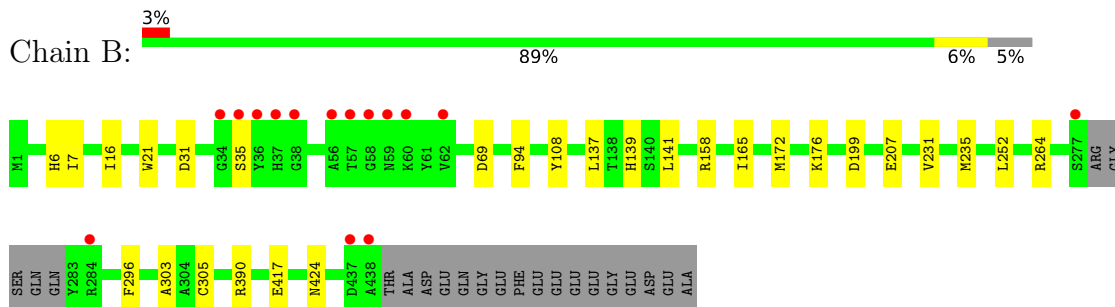
- Molecule 1: Tubulin alpha-1B chain



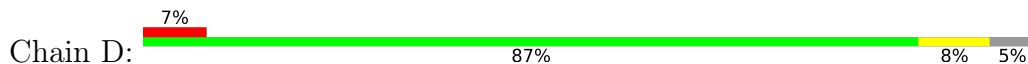
- Molecule 1: Tubulin alpha-1B chain

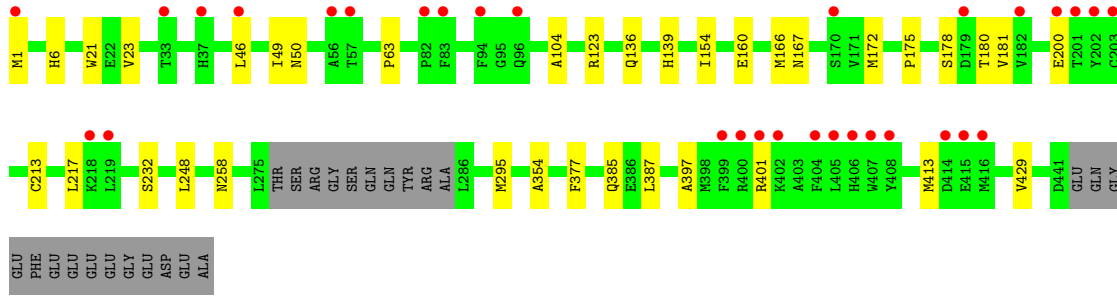


- Molecule 2: Tubulin beta-2B chain

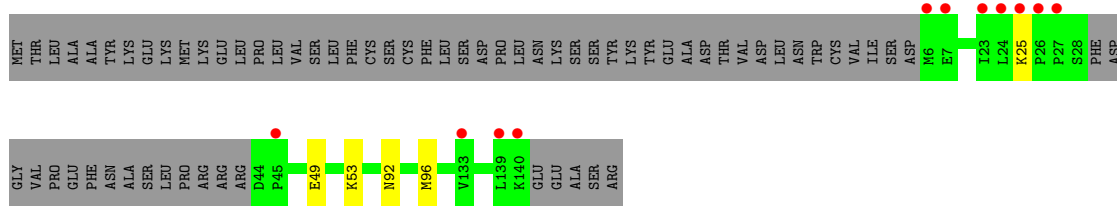


- Molecule 2: Tubulin beta-2B chain

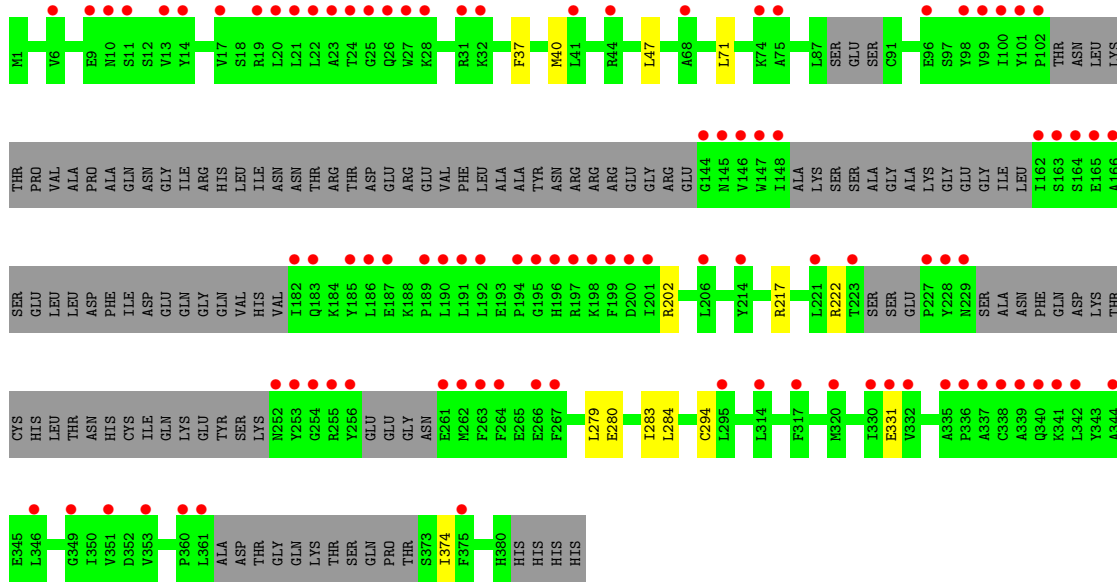




• Molecule 3: Stathmin-4



• Molecule 4: Tubulin beta-2B chain



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	104.71Å 156.97Å 181.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.66 – 2.50 49.66 – 2.50	Depositor EDS
% Data completeness (in resolution range)	100.0 (49.66-2.50) 100.0 (49.66-2.50)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.25 (at 2.51Å)	Xtriage
Refinement program	PHENIX 1.19	Depositor
R, $R_{free}$	0.197 , 0.235 0.196 , 0.196	Depositor DCC
$R_{free}$ test set	5239 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	54.1	Xtriage
Anisotropy	0.299	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	(Not available) , (Not available)	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	17266	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	67.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.49% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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 [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, MG, MES, ACP, CA, DMS, GDP, K9I, GTP, CL

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	0.27	0/3514	0.49	0/4769
1	C	0.29	0/3579	0.51	0/4858
2	B	0.28	0/3449	0.50	0/4671
2	D	0.26	0/3398	0.47	0/4603
3	E	0.27	0/1028	0.43	0/1364
4	F	0.25	0/2267	0.47	0/3058
All	All	0.27	0/17235	0.49	0/23323

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 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	3439	0	3351	16	0
1	C	3499	0	3396	17	0
2	B	3375	0	3243	17	0
2	D	3322	0	3203	20	0
3	E	1019	0	1028	3	0
4	F	2216	0	2220	8	0
5	A	32	0	12	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	C	32	0	12	0	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0
6	C	1	0	0	0	0
6	D	1	0	0	0	0
7	A	30	0	40	1	0
7	B	6	0	8	0	0
7	C	12	0	16	0	0
8	A	1	0	0	0	0
9	A	1	0	0	0	0
9	B	1	0	0	0	0
9	C	1	0	0	0	0
10	B	28	0	12	0	0
10	D	28	0	12	0	0
11	B	12	0	12	3	0
12	B	33	0	0	1	0
13	C	4	0	6	0	0
14	F	31	0	14	0	0
15	A	18	0	0	0	0
15	B	24	0	0	0	0
15	C	86	0	0	0	0
15	D	10	0	0	0	0
15	F	2	0	0	0	0
All	All	17266	0	16585	79	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 2.

All (79) 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)
2:B:264:ARG:HH12	2:B:424[B]:ASN:HD21	1.41	0.68
2:B:199:ASP:OD1	11:B:503:MES:H51	1.99	0.61
4:F:217:ARG:HE	4:F:374:ILE:HA	1.66	0.61
1:C:209:ILE:HG23	1:C:230:LEU:HD23	1.83	0.60
2:B:16[B]:ILE:HD13	2:B:231:VAL:HG11	1.82	0.60
1:C:244:PHE:CD1	1:C:358:GLN:HG3	2.41	0.56
1:A:34:GLY:HA3	1:A:60:LYS:HG3	1.88	0.55
4:F:202:ARG:HB2	4:F:222:ARG:HH11	1.73	0.54
1:C:172:TYR:CE2	1:C:391:LEU:HD22	2.44	0.53
2:B:158:ARG:CZ	11:B:503:MES:H61	2.37	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:4[B]:CYS:SG	1:C:136:LEU:HG	2.49	0.53
2:D:154:ILE:HG23	2:D:166:MET:HG2	1.91	0.53
2:D:248:LEU:HD23	2:D:354:ALA:HB2	1.90	0.53
1:A:209:ILE:HG23	1:A:230:LEU:HD23	1.91	0.52
1:A:217:LEU:HD21	1:A:368:LEU:HD23	1.92	0.52
2:B:176:LYS:HD2	2:B:207:GLU:HG3	1.91	0.51
2:B:199:ASP:OD2	11:B:503:MES:H31	2.12	0.50
2:D:167:ASN:ND2	2:D:200:GLU:HG3	2.27	0.50
2:B:6:HIS:CD2	2:B:21:TRP:HE1	2.29	0.49
2:D:123:ARG:NH2	2:D:160:GLU:OE2	2.42	0.49
2:D:1:MET:N	2:D:50[B]:ASN:OD1	2.45	0.49
1:A:172:TYR:HB3	1:A:205:ASP:HA	1.95	0.49
4:F:71:LEU:HD11	4:F:294:CYS:HB3	1.95	0.49
1:C:36:MET:HB3	1:C:61:HIS:CE1	2.48	0.48
4:F:280:GLU:HA	4:F:284:LEU:HB2	1.94	0.48
2:B:165:ILE:HG21	2:B:252:LEU:HB3	1.96	0.48
2:D:175:PRO:HA	2:D:178:SER:HB2	1.96	0.47
1:C:209:ILE:HG22	1:C:227:LEU:HD22	1.96	0.47
1:A:117:LEU:HD13	7:A:509:GOL:H32	1.97	0.47
1:C:93:ILE:HG22	1:C:114:ILE:HD11	1.96	0.47
1:A:274:PRO:HB3	1:A:286:LEU:HD12	1.97	0.47
1:C:172:TYR:HB3	1:C:205:ASP:HA	1.97	0.47
4:F:40:MET:HE1	4:F:47:LEU:HG	1.98	0.46
2:D:136:GLN:HA	2:D:167:ASN:O	2.16	0.46
1:C:167:LEU:HG	1:C:200:CYS:HB3	1.98	0.46
2:D:23:VAL:HG21	2:D:232:SER:HB2	1.98	0.46
2:B:141:LEU:HD12	2:B:172:MET:SD	2.56	0.45
2:D:21:TRP:CZ3	2:D:63:PRO:HB3	2.50	0.45
1:C:335:ILE:HG23	1:C:339:ARG:HG3	1.98	0.45
2:D:46:LEU:HA	2:D:49:ILE:HB	1.99	0.45
2:D:172:MET:HG3	2:D:387:LEU:HD11	1.97	0.45
2:B:303:ALA:O	2:B:305:CYS:N	2.47	0.45
1:C:320:ARG:HA	1:C:356:ASN:O	2.16	0.44
2:D:6:HIS:CD2	2:D:21:TRP:HE1	2.35	0.44
1:A:166:LYS:HE2	1:A:197:HIS:O	2.17	0.44
1:A:21:TRP:CZ3	1:A:63:PRO:HB3	2.52	0.44
2:D:385:GLN:HB2	2:D:429:VAL:HG13	1.99	0.44
1:A:76:ASP:O	1:A:80:THR:HG22	2.18	0.43
1:A:36:MET:HB3	1:A:61:HIS:CE1	2.54	0.43
2:D:397:ALA:O	2:D:401:ARG:NH1	2.51	0.43
1:C:7:ILE:HG21	1:C:153:LEU:HD21	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:104:ALA:HB2	2:D:413:MET:SD	2.58	0.43
4:F:37:PHE:CE1	4:F:40:MET:HB2	2.54	0.43
1:A:409:VAL:HA	1:A:413:MET:O	2.19	0.43
2:B:207:GLU:OE1	2:B:390:ARG:NH1	2.51	0.43
2:D:180:THR:OG1	2:D:181:VAL:N	2.52	0.43
1:A:335:ILE:HG23	1:A:339:ARG:HG3	2.00	0.42
1:C:140:SER:HA	1:C:171:ILE:HB	2.01	0.42
2:D:167:ASN:HD22	2:D:200:GLU:HG3	1.83	0.42
2:B:108:TYR:OH	2:B:417:GLU:OE2	2.22	0.42
2:D:213:CYS:HA	2:D:217:LEU:HB2	2.00	0.42
3:E:49[B]:GLU:HG2	3:E:53:LYS:HE3	2.01	0.42
2:B:69:ASP:O	2:B:94:PHE:HA	2.19	0.42
2:D:295:MET:CG	2:D:377:PHE:HB2	2.50	0.42
1:A:210:TYR:CE2	1:A:214:ARG:HD2	2.54	0.42
1:A:349:THR:HB	3:E:25:LYS:HB3	2.01	0.42
3:E:92:ASN:O	3:E:96:MET:HG2	2.20	0.42
4:F:202:ARG:HB2	4:F:222:ARG:NH1	2.34	0.41
1:A:141:PHE:O	1:A:147:SER:HB3	2.21	0.41
1:C:180:ALA:HA	2:D:258:ASN:OD1	2.21	0.41
1:C:210:TYR:CZ	1:C:222:PRO:HD2	2.56	0.41
4:F:279:LEU:HD12	4:F:283:ILE:HB	2.02	0.41
2:B:31:ASP:OD1	2:B:35:SER:N	2.53	0.40
2:B:235:MET:HE2	2:B:235:MET:HB3	1.92	0.40
1:C:119:LEU:HD11	1:C:156:ARG:HB3	2.02	0.40
1:C:275:VAL:HG13	1:C:368:LEU:HD21	2.03	0.40
1:A:180:ALA:O	1:A:183:GLU:HG3	2.22	0.40
2:B:7:ILE:O	2:B:137:LEU:HA	2.22	0.40
2:B:296:PHE:O	12:B:506:K9I:O05	2.39	0.40

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	437/451 (97%)	425 (97%)	12 (3%)	0	100	100
1	C	445/451 (99%)	437 (98%)	8 (2%)	0	100	100
2	B	425/445 (96%)	417 (98%)	8 (2%)	0	100	100
2	D	419/445 (94%)	410 (98%)	9 (2%)	0	100	100
3	E	119/189 (63%)	118 (99%)	1 (1%)	0	100	100
4	F	250/384 (65%)	241 (96%)	9 (4%)	0	100	100
All	All	2095/2365 (89%)	2048 (98%)	47 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	373/379 (98%)	370 (99%)	3 (1%)	81	93
1	C	380/379 (100%)	378 (100%)	2 (0%)	88	96
2	B	372/383 (97%)	371 (100%)	1 (0%)	92	97
2	D	366/383 (96%)	365 (100%)	1 (0%)	92	97
3	E	111/171 (65%)	111 (100%)	0	100	100
4	F	243/342 (71%)	242 (100%)	1 (0%)	91	97
All	All	1845/2037 (91%)	1837 (100%)	8 (0%)	91	97

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

Mol	Chain	Res	Type
1	A	71	GLU
1	A	221	ARG
1	A	381	THR
2	B	139	HIS
1	C	71	GLU
1	C	381	THR
2	D	139	HIS

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Mol	Chain	Res	Type
4	F	331	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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](#)

Of 24 ligands modelled in this entry, 8 are monoatomic - leaving 16 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
10	GDP	B	501	6	24,30,30	0.98	1 (4%)	30,47,47	1.07	3 (10%)
7	GOL	B	505	-	5,5,5	1.00	0	5,5,5	0.75	0
13	DMS	C	506	-	3,3,3	0.68	0	3,3,3	0.68	0
14	ACP	F	401	-	27,33,33	0.81	1 (3%)	32,52,52	1.39	2 (6%)
7	GOL	C	503	-	5,5,5	0.90	0	5,5,5	0.95	0
12	K9I	B	506	-	32,34,34	1.71	4 (12%)	38,48,48	1.38	4 (10%)
5	GTP	A	501	6	26,34,34	1.10	2 (7%)	32,54,54	1.42	5 (15%)
7	GOL	A	508	-	5,5,5	0.80	0	5,5,5	1.01	0
7	GOL	A	503	-	5,5,5	0.84	0	5,5,5	1.11	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
7	GOL	C	505	-	5,5,5	0.79	0	5,5,5	1.06	0
11	MES	B	503	-	12,12,12	1.99	1 (8%)	14,16,16	2.18	7 (50%)
5	GTP	C	501	6	26,34,34	1.12	2 (7%)	32,54,54	1.34	6 (18%)
7	GOL	A	509	-	5,5,5	1.04	0	5,5,5	0.88	0
7	GOL	A	505	-	5,5,5	0.93	0	5,5,5	0.97	0
10	GDP	D	501	6	24,30,30	0.94	1 (4%)	30,47,47	1.21	4 (13%)
7	GOL	A	507	-	5,5,5	0.86	0	5,5,5	1.08	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
10	GDP	B	501	6	-	4/12/32/32	0/3/3/3
7	GOL	B	505	-	-	0/4/4/4	-
14	ACP	F	401	-	-	3/15/38/38	0/3/3/3
7	GOL	C	503	-	-	0/4/4/4	-
12	K9I	B	506	-	-	14/50/50/50	0/1/2/2
5	GTP	A	501	6	-	5/18/38/38	0/3/3/3
7	GOL	A	508	-	-	1/4/4/4	-
7	GOL	A	503	-	-	0/4/4/4	-
7	GOL	C	505	-	-	0/4/4/4	-
11	MES	B	503	-	-	2/6/14/14	0/1/1/1
5	GTP	C	501	6	-	8/18/38/38	0/3/3/3
7	GOL	A	509	-	-	0/4/4/4	-
7	GOL	A	505	-	-	0/4/4/4	-
10	GDP	D	501	6	-	3/12/32/32	0/3/3/3
7	GOL	A	507	-	-	0/4/4/4	-

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
11	B	503	MES	C8-S	-6.57	1.68	1.77
12	B	506	K9I	O31-C29	5.09	1.46	1.34
12	B	506	K9I	C15-C18	4.61	1.62	1.54
5	C	501	GTP	C5-C6	-3.83	1.39	1.47
5	A	501	GTP	C5-C6	-3.76	1.39	1.47
14	F	401	ACP	PB-O3A	3.11	1.61	1.58
10	B	501	GDP	C6-N1	-2.62	1.34	1.37

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
12	B	506	K9I	C03-C06	2.54	1.54	1.50
10	D	501	GDP	C6-N1	-2.34	1.34	1.37
5	A	501	GTP	C2-N3	2.02	1.38	1.33
12	B	506	K9I	O31-C09	-2.01	1.42	1.45
5	C	501	GTP	C2-N3	2.01	1.38	1.33

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
14	F	401	ACP	PB-O3A-PA	-7.22	109.67	132.56
12	B	506	K9I	O31-C29-C27	4.57	118.64	111.15
11	B	503	MES	C5-N4-C3	4.53	119.02	108.83
12	B	506	K9I	C10-C09-C07	-3.44	108.71	113.50
10	D	501	GDP	PA-O3A-PB	-3.14	122.05	132.83
5	A	501	GTP	C8-N7-C5	3.09	108.88	102.99
11	B	503	MES	C7-N4-C3	3.07	119.08	111.23
5	C	501	GTP	C5-C6-N1	3.06	119.36	113.95
5	C	501	GTP	C8-N7-C5	3.00	108.70	102.99
5	A	501	GTP	C5-C6-N1	2.99	119.24	113.95
11	B	503	MES	O1S-S-C8	2.91	110.42	106.92
12	B	506	K9I	C08-C07-C09	-2.87	108.42	115.07
5	A	501	GTP	PA-O3A-PB	-2.59	123.94	132.83
5	C	501	GTP	PB-O3B-PG	-2.57	124.00	132.83
10	B	501	GDP	C8-N7-C5	2.52	107.80	102.99
10	B	501	GDP	C5-C6-N1	2.50	118.37	113.95
5	C	501	GTP	C2-N1-C6	-2.50	120.50	125.10
5	A	501	GTP	C2-N1-C6	-2.47	120.55	125.10
11	B	503	MES	O2S-S-C8	2.46	109.87	106.92
10	D	501	GDP	C8-N7-C5	2.41	107.58	102.99
10	D	501	GDP	C3'-C2'-C1'	2.38	104.56	100.98
5	C	501	GTP	PA-O3A-PB	-2.35	124.77	132.83
5	A	501	GTP	O2G-PG-O3B	2.31	112.40	104.64
10	B	501	GDP	PA-O3A-PB	-2.30	124.92	132.83
11	B	503	MES	C7-N4-C5	2.28	117.07	111.23
14	F	401	ACP	C5-C6-N6	2.25	123.78	120.35
12	B	506	K9I	C20-C24-C25	-2.23	109.62	113.61
10	D	501	GDP	C5-C6-N1	2.19	117.82	113.95
11	B	503	MES	O3S-S-C8	2.15	109.24	105.77
5	C	501	GTP	O3'-C3'-C4'	-2.14	104.87	111.05
11	B	503	MES	C2-C3-N4	-2.07	106.97	110.10

There are no chirality outliers.

All (40) torsion outliers are listed below:

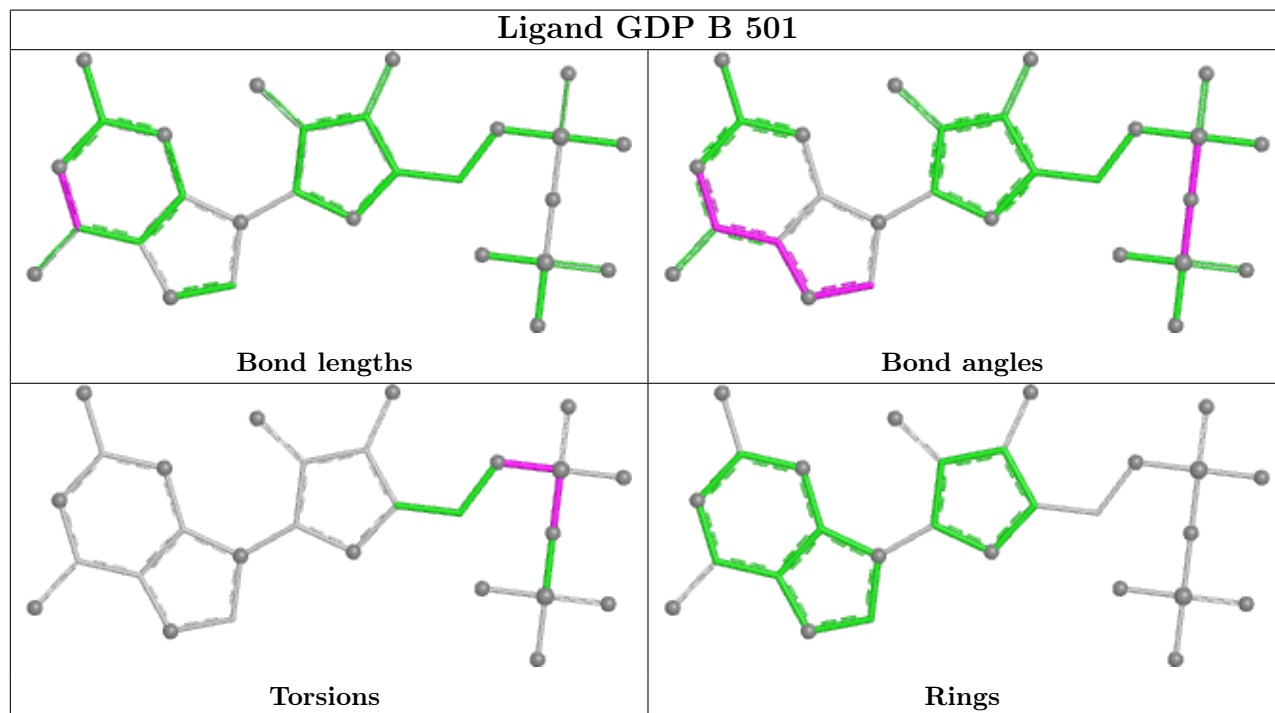
Mol	Chain	Res	Type	Atoms
5	A	501	GTP	PB-O3B-PG-O2G
5	A	501	GTP	C5'-O5'-PA-O1A
5	A	501	GTP	C5'-O5'-PA-O2A
5	C	501	GTP	C5'-O5'-PA-O1A
10	B	501	GDP	C5'-O5'-PA-O1A
10	D	501	GDP	C5'-O5'-PA-O1A
10	D	501	GDP	C5'-O5'-PA-O2A
12	B	506	K9I	C09-C10-C11-O32
12	B	506	K9I	O14-C13-C15-C17
14	F	401	ACP	C5'-O5'-PA-O3A
12	B	506	K9I	C03-C06-C07-C09
12	B	506	K9I	C09-C10-C11-C12
12	B	506	K9I	C03-C06-C07-C08
11	B	503	MES	C8-C7-N4-C3
11	B	503	MES	C8-C7-N4-C5
5	C	501	GTP	PB-O3B-PG-O1G
5	A	501	GTP	C5'-O5'-PA-O3A
12	B	506	K9I	C10-C11-O32-C33
12	B	506	K9I	C12-C11-O32-C33
5	C	501	GTP	C5'-O5'-PA-O2A
10	B	501	GDP	C5'-O5'-PA-O2A
14	F	401	ACP	C5'-O5'-PA-O1A
14	F	401	ACP	C5'-O5'-PA-O2A
12	B	506	K9I	C25-C27-C29-O31
10	B	501	GDP	PB-O3A-PA-O2A
7	A	508	GOL	O1-C1-C2-C3
12	B	506	K9I	C16-C15-C18-C19
12	B	506	K9I	C16-C15-C18-C23
5	A	501	GTP	PB-O3B-PG-O3G
5	C	501	GTP	PB-O3B-PG-O2G
5	C	501	GTP	PB-O3B-PG-O3G
5	C	501	GTP	C5'-O5'-PA-O3A
10	B	501	GDP	C5'-O5'-PA-O3A
10	D	501	GDP	C5'-O5'-PA-O3A
12	B	506	K9I	C21-C20-C24-C25
5	C	501	GTP	PB-O3A-PA-O1A
5	C	501	GTP	PB-O3A-PA-O2A
12	B	506	K9I	C12-C13-C15-C17
12	B	506	K9I	C17-C15-C18-C19
12	B	506	K9I	C19-C20-C24-C25

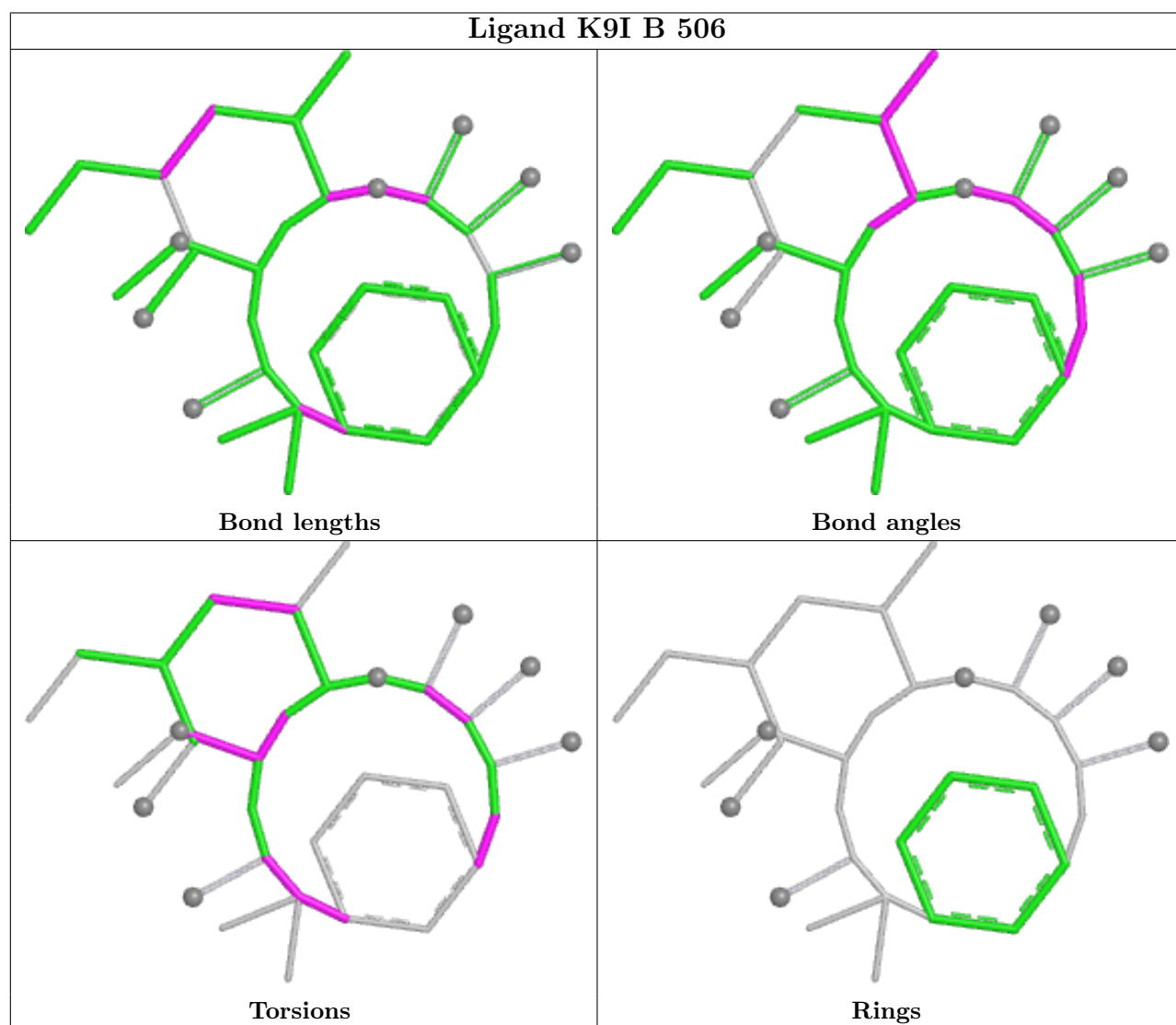
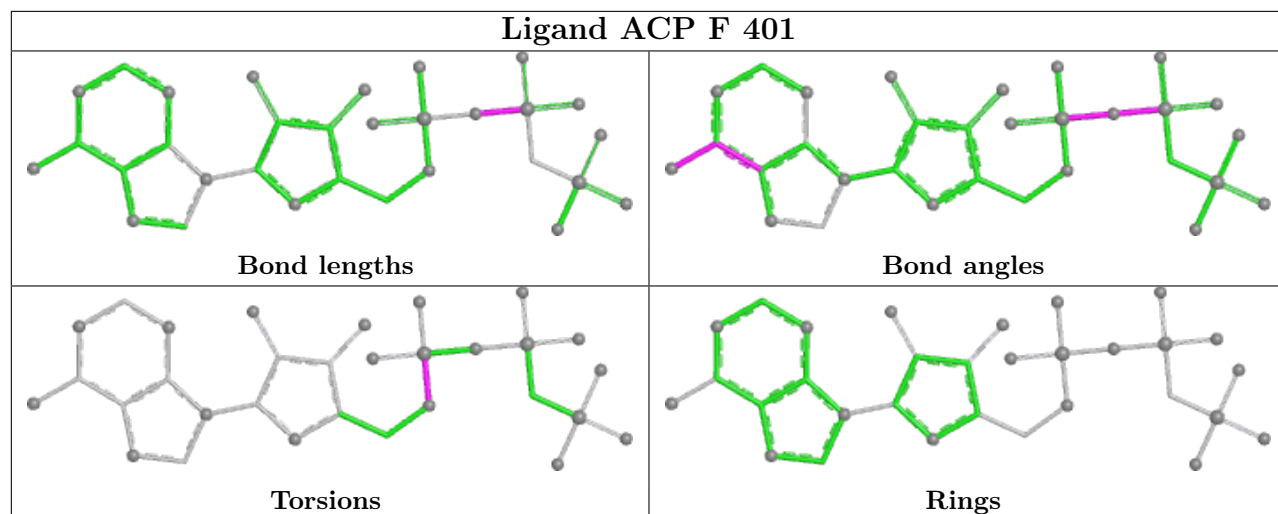
There are no ring outliers.

3 monomers are involved in 5 short contacts:

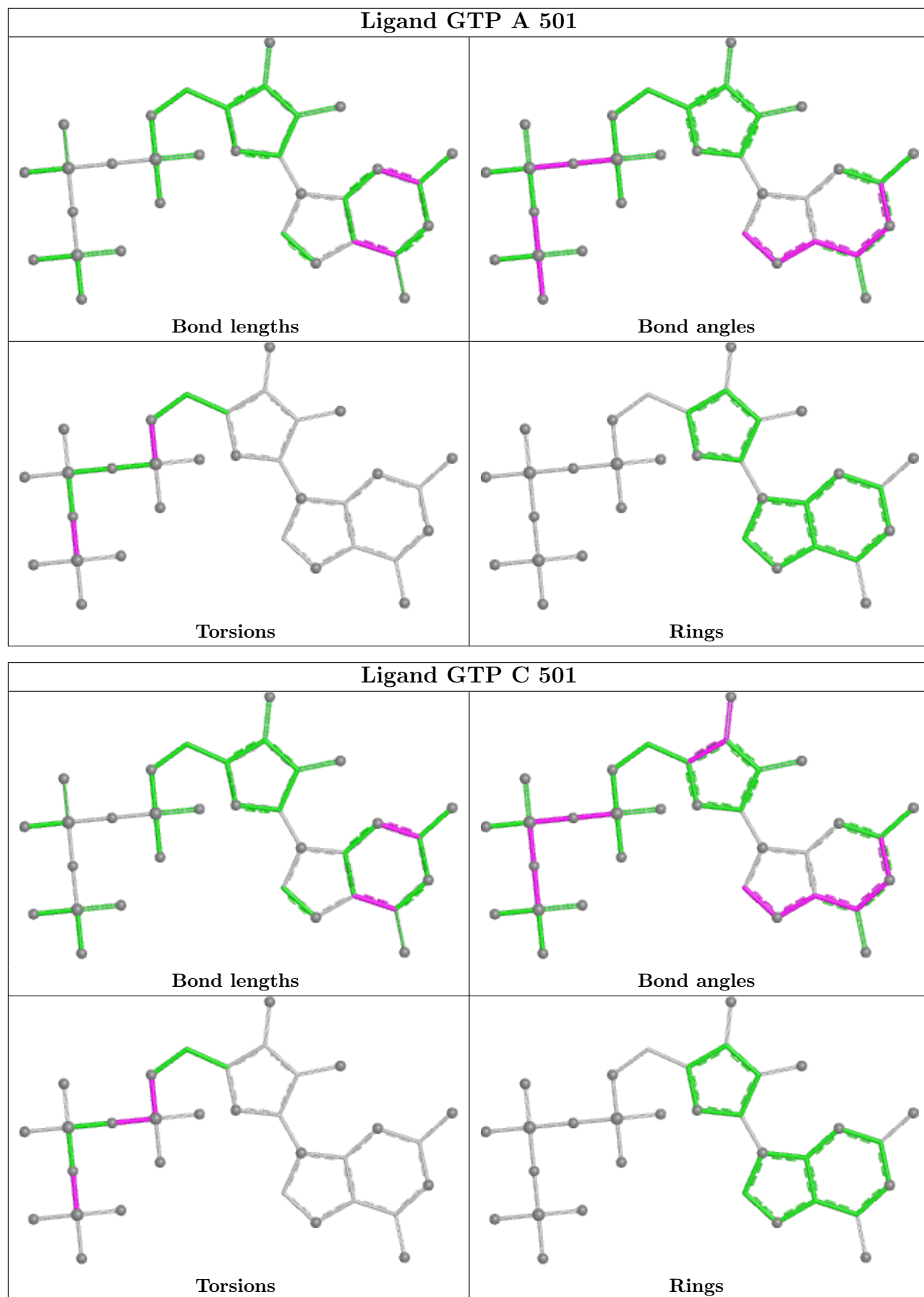
Mol	Chain	Res	Type	Clashes	Symm-Clashes
12	B	506	K9I	1	0
11	B	503	MES	3	0
7	A	509	GOL	1	0

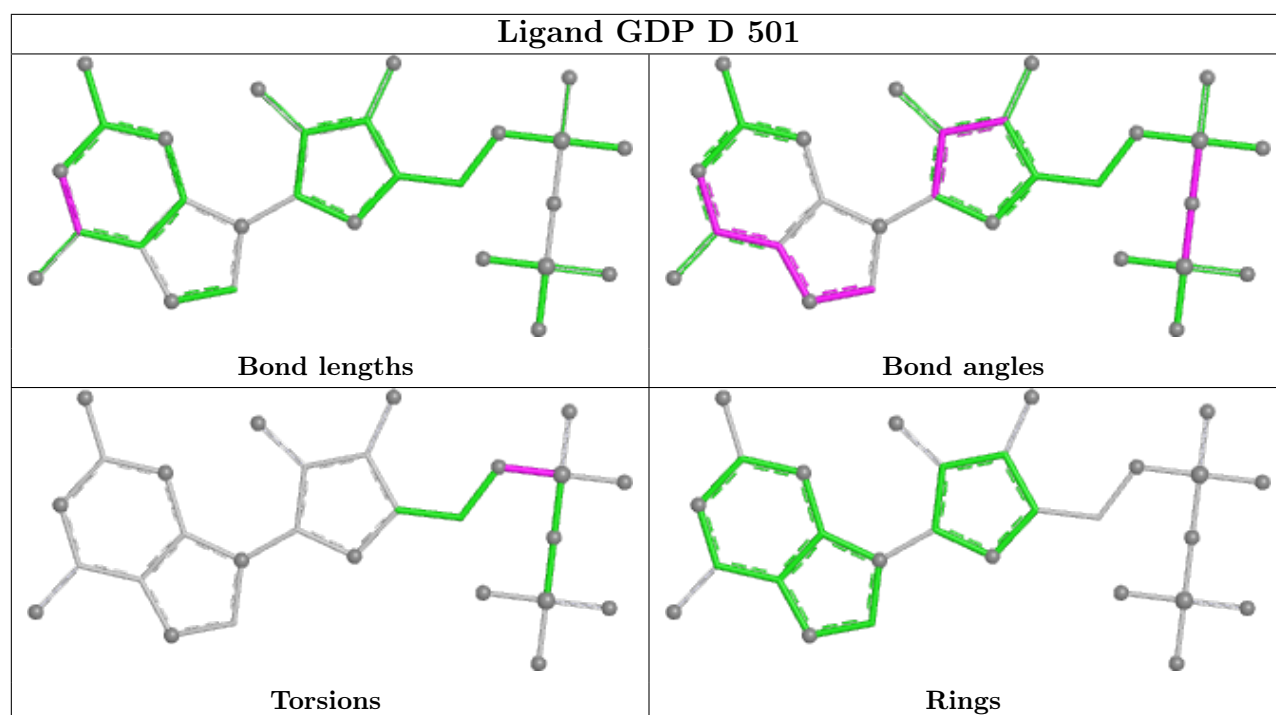
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	434/451 (96%)	0.31	10 (2%) 60 63	37, 59, 96, 120	0
1	C	439/451 (97%)	0.01	3 (0%) 87 89	32, 47, 74, 104	0
2	B	423/445 (95%)	0.15	15 (3%) 44 47	28, 53, 86, 142	2 (0%)
2	D	421/445 (94%)	0.52	31 (7%) 14 15	42, 73, 106, 150	2 (0%)
3	E	120/189 (63%)	0.43	11 (9%) 9 9	43, 73, 112, 124	0
4	F	268/384 (69%)	1.75	98 (36%) 0 0	53, 95, 130, 154	5 (1%)
All	All	2105/2365 (89%)	0.45	168 (7%) 12 12	28, 62, 110, 154	9 (0%)

All (168) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	F	253	TYR	7.5
4	F	99	VAL	7.4
4	F	199	PHE	7.3
4	F	256	TYR	7.1
4	F	190	LEU	6.9
4	F	252	ASN	6.8
4	F	223	THR	6.2
4	F	101	TYR	6.1
2	D	1	MET	6.0
4	F	20	LEU	5.8
4	F	163	SER	5.8
4	F	254	GLY	5.8
4	F	191	LEU	5.6
2	D	57	THR	5.4
4	F	197	ARG	5.3
4	F	147	TRP	5.2
4	F	346	LEU	5.0
4	F	17	VAL	5.0
4	F	13	VAL	4.9

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
4	F	320	MET	4.9
2	B	59	ASN	4.8
4	F	145	ASN	4.8
4	F	100	ILE	4.6
4	F	26	GLN	4.6
4	F	344	ALA	4.5
4	F	196	HIS	4.5
4	F	192	LEU	4.5
2	D	94	PHE	4.5
4	F	182	ILE	4.4
4	F	194	PRO	4.4
2	B	57	THR	4.4
4	F	255	ARG	4.4
4	F	98	TYR	4.4
4	F	228	TYR	4.4
4	F	198	LYS	4.4
4	F	201	ILE	4.3
3	E	27	PRO	4.3
4	F	9	GLU	4.3
4	F	164	SER	4.3
4	F	338	CYS	4.2
4	F	165	GLU	4.2
4	F	25	GLY	4.2
4	F	148	ILE	4.1
2	D	405	LEU	4.0
1	A	262	TYR	4.0
4	F	162	ILE	4.0
4	F	102	PRO	3.9
4	F	200	ASP	3.8
4	F	229	ASN	3.8
2	D	400	ARG	3.7
4	F	195	GLY	3.7
4	F	183	GLN	3.7
4	F	21	LEU	3.6
4	F	339	ALA	3.6
4	F	337	ALA	3.6
4	F	336	PRO	3.6
4	F	32	LYS	3.6
2	D	182	VAL	3.5
4	F	340	GLN	3.5
3	E	26	PRO	3.4
4	F	185	TYR	3.3

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
4	F	187	GLU	3.2
4	F	24	THR	3.1
4	F	221	LEU	3.1
3	E	139	LEU	3.1
4	F	206	LEU	3.1
2	D	415	GLU	3.1
2	B	58	GLY	3.1
4	F	6	VAL	3.0
2	D	404	PHE	3.0
1	A	346	TRP	3.0
2	D	202	TYR	3.0
4	F	360	PRO	3.0
4	F	146	VAL	3.0
2	D	402	LYS	3.0
4	F	263	PHE	2.9
4	F	144	GLY	2.9
4	F	295	LEU	2.9
2	D	179	ASP	2.9
4	F	44	ARG	2.8
4	F	267	PHE	2.8
2	B	37	HIS	2.8
4	F	14	TYR	2.8
4	F	332	VAL	2.8
1	A	42	ILE	2.8
2	D	203	CYS	2.8
2	B	36	TYR	2.8
2	D	218	LYS	2.7
2	D	37	HIS	2.7
4	F	261	GLU	2.7
2	D	401	ARG	2.7
4	F	331	GLU	2.7
3	E	133	VAL	2.7
2	D	399	PHE	2.7
4	F	28	LYS	2.7
1	A	364	PRO	2.7
2	D	83	PHE	2.6
4	F	330	ILE	2.6
1	A	201	ALA	2.6
2	B	284	ARG	2.5
4	F	262	MET	2.5
2	D	406	HIS	2.5
4	F	266	GLU	2.5

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
4	F	23	ALA	2.5
1	A	88	HIS	2.5
4	F	375	PHE	2.5
4	F	31	ARG	2.5
2	D	416	MET	2.5
4	F	74	LYS	2.5
2	B	438	ALA	2.5
4	F	351	VAL	2.4
1	A	171	ILE	2.4
4	F	227	PRO	2.4
2	B	56	ALA	2.4
4	F	353	VAL	2.4
2	D	56	ALA	2.4
2	D	33	THR	2.4
3	E	6	MET	2.4
2	D	201	THR	2.4
4	F	75	ALA	2.3
4	F	27	TRP	2.3
2	B	62	VAL	2.3
2	B	35	SER	2.3
3	E	23	ILE	2.3
4	F	41	LEU	2.3
4	F	361	LEU	2.3
3	E	25	LYS	2.3
2	B	277	SER	2.3
4	F	19	ARG	2.3
2	D	170	SER	2.3
3	E	140	LYS	2.3
4	F	214	TYR	2.3
3	E	24	LEU	2.3
4	F	186	LEU	2.3
3	E	45	PRO	2.3
4	F	341	LYS	2.3
4	F	68	ALA	2.3
4	F	317	PHE	2.3
2	D	200	GLU	2.3
2	D	408	TYR	2.2
4	F	189	PRO	2.2
4	F	342	LEU	2.2
1	C	1	MET	2.2
2	D	46	LEU	2.2
2	B	60	LYS	2.2

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Mol	Chain	Res	Type	RSRZ
2	B	38	GLY	2.2
4	F	11	SER	2.2
4	F	96	GLU	2.2
2	D	219	LEU	2.2
2	D	407	TRP	2.1
1	C	440	VAL	2.1
1	A	43	GLY	2.1
4	F	335	ALA	2.1
4	F	22	LEU	2.1
4	F	314	LEU	2.1
2	B	437	ASP	2.1
4	F	166	ALA	2.1
4	F	264	PHE	2.1
4	F	10	ASN	2.1
2	D	96	GLN	2.1
1	A	56	THR	2.1
1	A	170	SER	2.1
1	C	357	TYR	2.1
2	B	34	GLY	2.1
4	F	349	GLY	2.1
2	D	414	ASP	2.0
2	D	82	PRO	2.0
3	E	7	GLU	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

## 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 6.4 Ligands [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, 95<sup>th</sup> 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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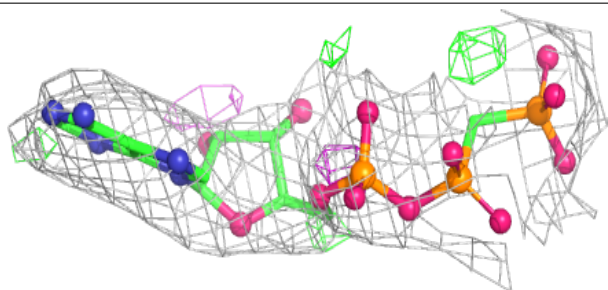
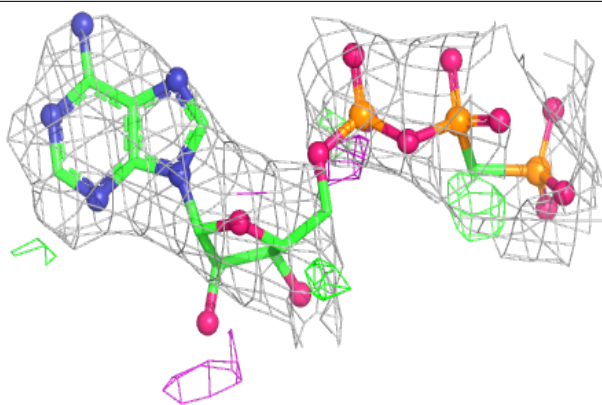
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
7	GOL	A	509	6/6	0.71	0.26	72,75,83,93	0
7	GOL	C	503	6/6	0.77	0.15	65,72,76,79	0
14	ACP	F	401	31/31	0.78	0.28	96,102,108,113	31
7	GOL	B	505	6/6	0.79	0.22	61,64,65,68	0
7	GOL	A	505	6/6	0.80	0.24	65,69,73,74	6
7	GOL	A	507	6/6	0.85	0.22	60,60,67,75	0
7	GOL	A	503	6/6	0.87	0.32	60,64,65,67	6
7	GOL	C	505	6/6	0.88	0.31	55,57,65,75	0
13	DMS	C	506	4/4	0.89	0.14	48,63,65,76	4
8	CL	A	504	1/1	0.90	0.08	71,71,71,71	0
12	K9I	B	506	33/33	0.90	0.18	54,62,69,71	0
7	GOL	A	508	6/6	0.91	0.25	58,63,65,68	0
6	MG	D	502	1/1	0.91	0.12	68,68,68,68	0
9	CA	A	506	1/1	0.91	0.09	79,79,79,79	0
11	MES	B	503	12/12	0.95	0.20	43,47,58,60	12
10	GDP	D	501	28/28	0.95	0.16	60,67,74,84	0
9	CA	B	504	1/1	0.96	0.08	79,79,79,79	0
6	MG	B	502	1/1	0.96	0.17	35,35,35,35	0
6	MG	C	502	1/1	0.97	0.13	38,38,38,38	0
6	MG	A	502	1/1	0.97	0.17	40,40,40,40	0
5	GTP	A	501	32/32	0.97	0.23	37,42,47,49	0
10	GDP	B	501	28/28	0.98	0.18	30,40,43,49	0
5	GTP	C	501	32/32	0.98	0.15	29,37,42,45	0
9	CA	C	504	1/1	0.99	0.04	58,58,58,58	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.



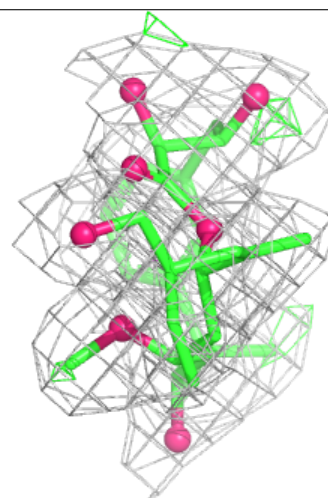
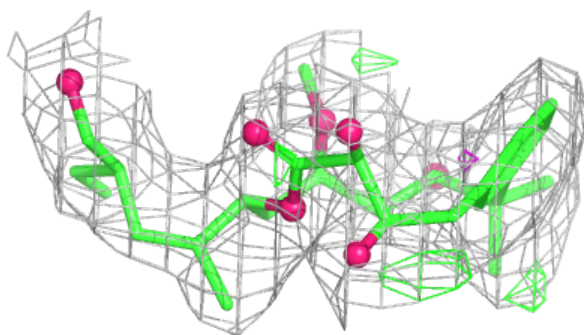
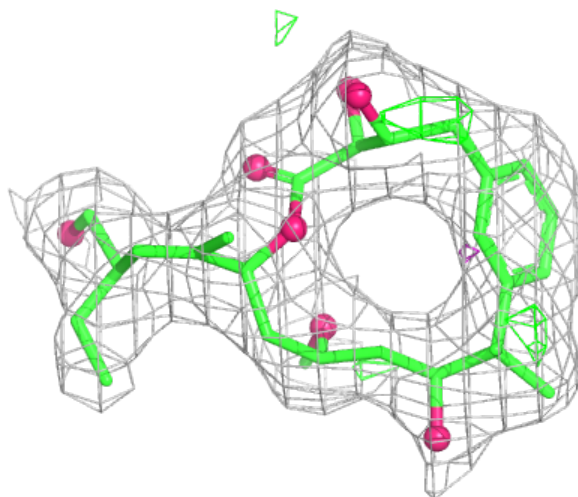
**Electron density around ACP F 401:**

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



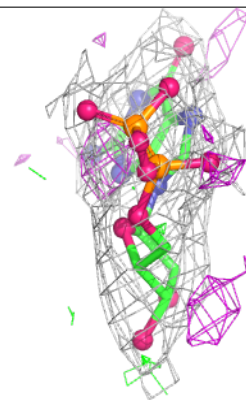
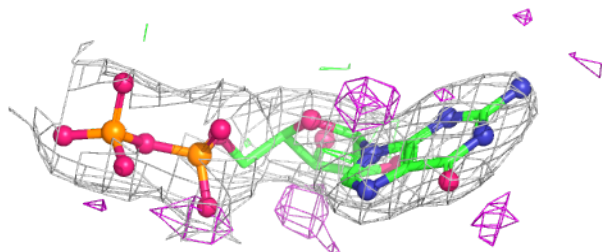
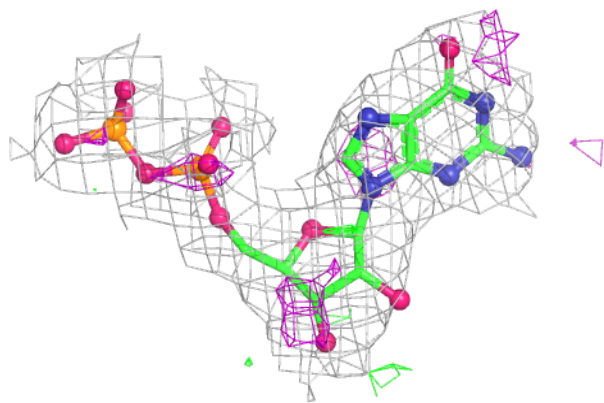
**Electron density around K9I B 506:**

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

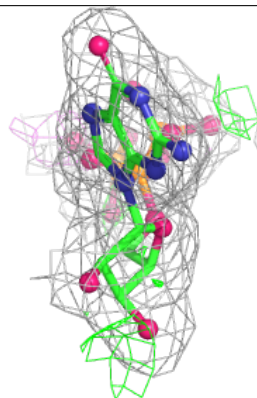
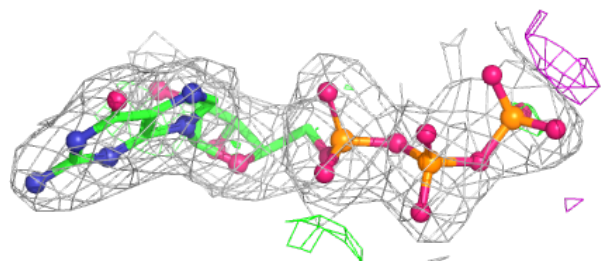
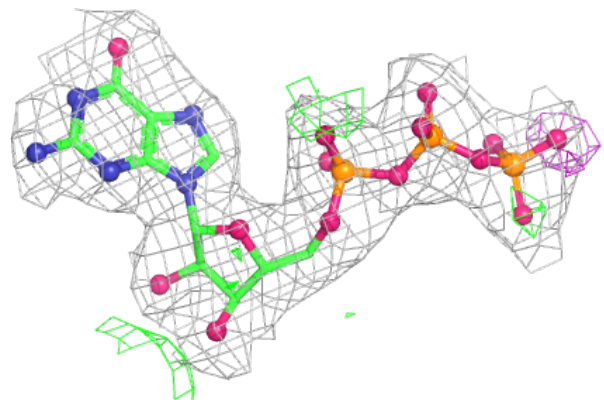


**Electron density around GDP D 501:**

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

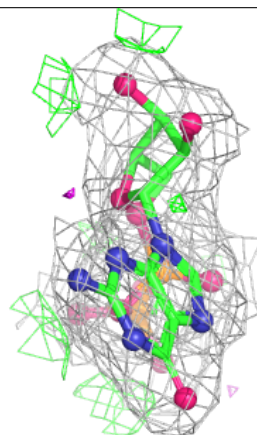
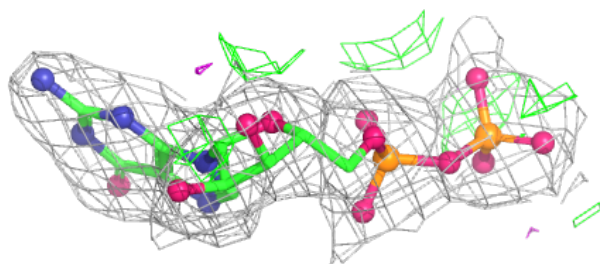
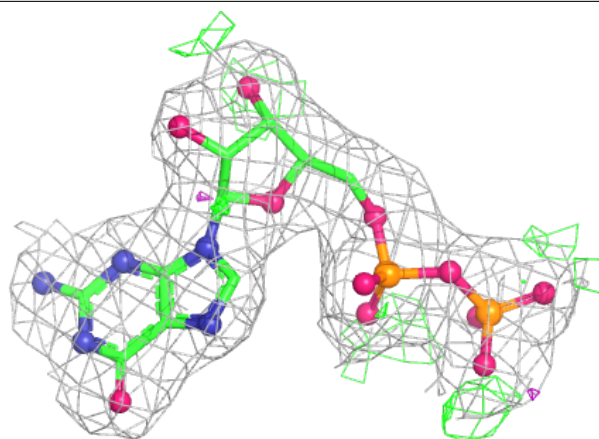
**Electron density around GTP A 501:**

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

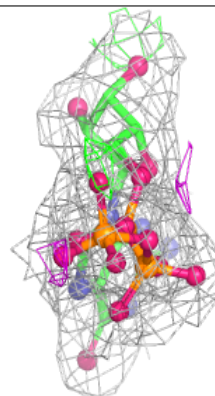
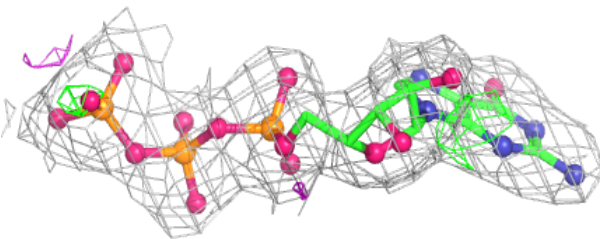
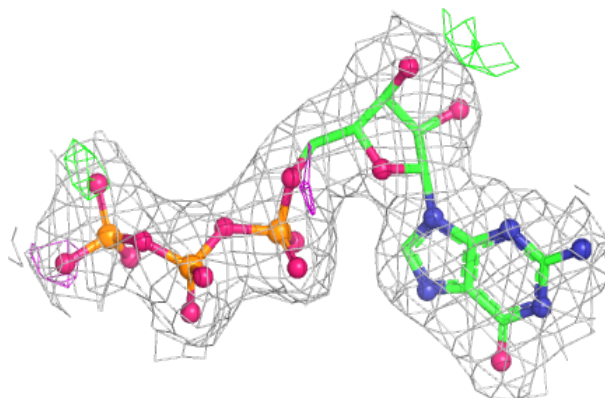


**Electron density around GDP B 501:**

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

**Electron density around GTP 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)



## 6.5 Other polymers [i](#)

There are no such residues in this entry.