Full wwPDB EM Validation Report

Jul 9, 2025 – 12:48 PM JST

PDB ID	:	8WDB / pdb_00008wdb
EMDB ID	:	EMD-37460
Title	:	Cryo-EM structure of the ATP-bound DppABCD complex
Authors	:	Hu, T.; Zhang, B.; Rao, Z.
Deposited on	:	2023-09-14
Resolution	:	2.86 Å(reported)

This is a Full wwPDB EM 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/EMValidationReportHelp
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:

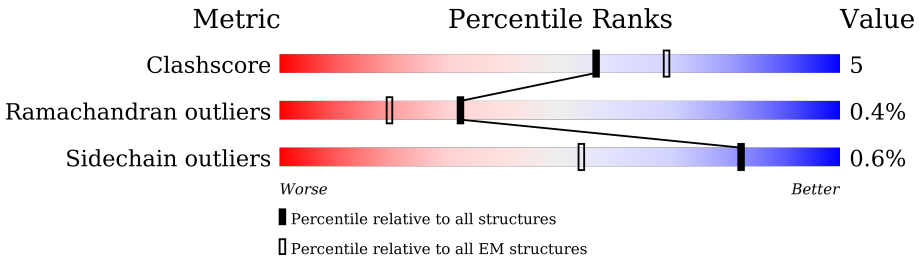
EMDB validation analysis	:	FAILED
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4-5-2 with Phenix2.0rc1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	FAILED
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.44

1 Overall quality at a glance

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 2.86 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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%

Mol	Chain	Length	Quality of chain
1	D	548	81% 12% 6%
2	B	308	86% 14%
3	C	287	86% 10% • • •
4	A	517	90% 10%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 12322 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Probable dipeptide-transport ATP-binding protein ABC transporter DppD.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	D	513	Total	C	N	O	S	0	0
			3892	2428	738	718	8		

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	179	GLN	GLU	engineered mutation	UNP I6Y482
D	457	GLN	GLU	engineered mutation	UNP I6Y482

- Molecule 2 is a protein called Probable dipeptide-transport integral membrane protein ABC transporter DppB.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	308	Total	C	N	O	S	0	0
			2302	1517	392	388	5		

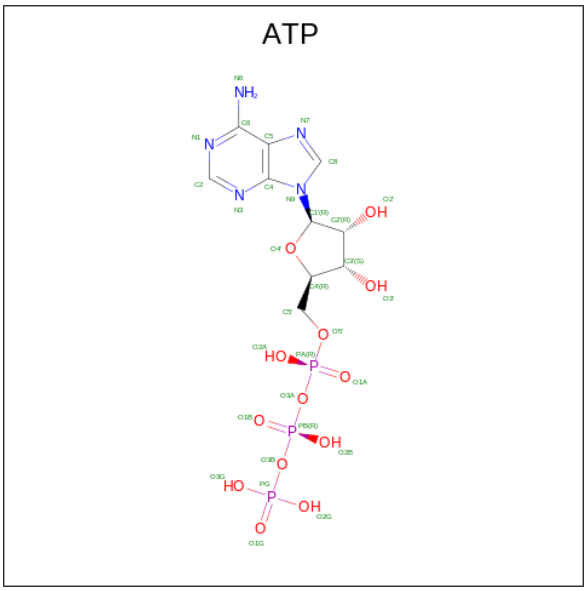
- Molecule 3 is a protein called Probable dipeptide-transport integral membrane protein ABC transporter DppC.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	281	Total	C	N	O	S	0	0
			2102	1379	359	357	7		

- Molecule 4 is a protein called Probable periplasmic dipeptide-binding lipoprotein DppA.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	A	517	Total	C	N	O	S	0	0
			3962	2503	699	753	7		

- Molecule 5 is ADENOSINE-5'-TRIPHOSPHATE (CCD ID: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
5	D	1	Total	C	N	O	P	0
			31	10	5	13	3	
5	D	1	Total	C	N	O	P	0
			31	10	5	13	3	

- Molecule 6 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

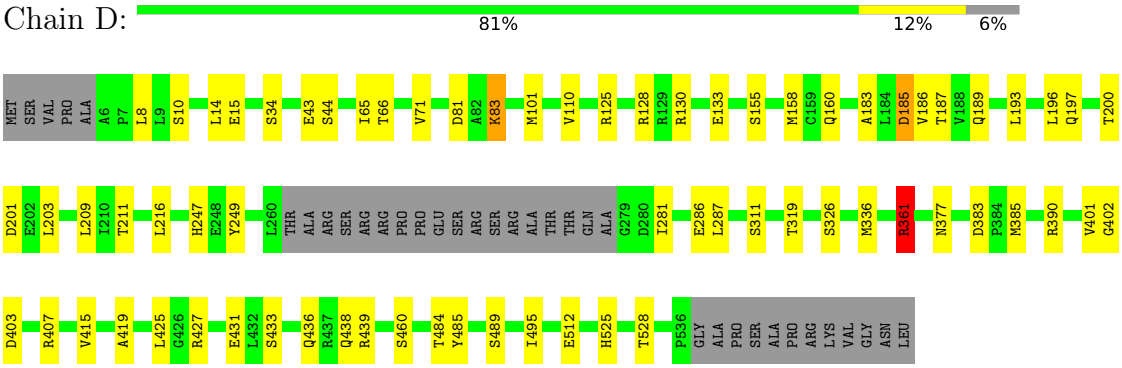
Mol	Chain	Residues	Atoms		AltConf
6	D	2	Total	Mg	0
			2	2	

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. 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. 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.

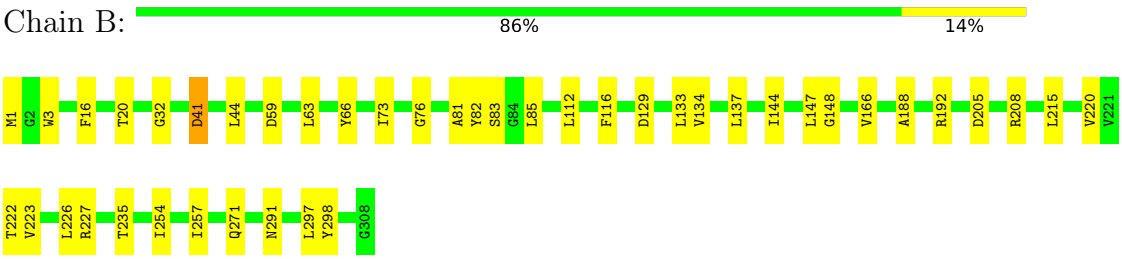
• Molecule 1: Probable dipeptide-transport ATP-binding protein ABC transporter DppD

Chain D:



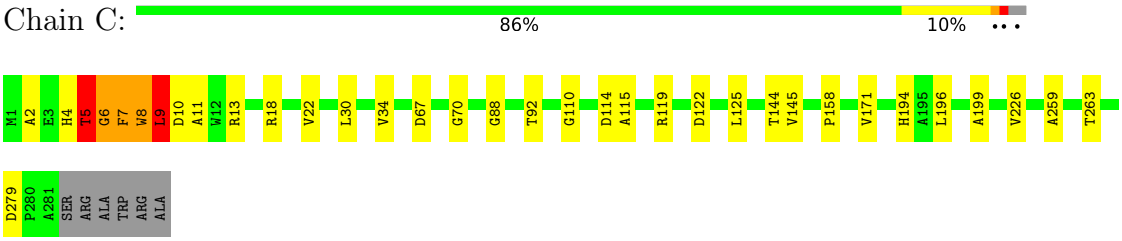
• Molecule 2: Probable dipeptide-transport integral membrane protein ABC transporter DppB

Chain B:



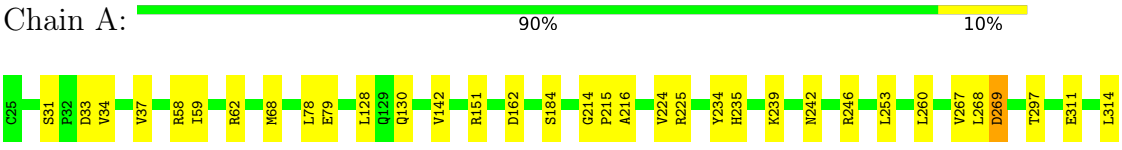
• Molecule 3: Probable dipeptide-transport integral membrane protein ABC transporter DppC

Chain C:



• Molecule 4: Probable periplasmic dipeptide-binding lipoprotein DppA

Chain A:




R315
F343
R346
F351
Q374
Y385
A414
P420
Y446
E451
A461
N464
Q497
P508
V516
E536
N537
I538
A541

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	65444	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/Å^2$)	60	Depositor
Minimum defocus (nm)	1400	Depositor
Maximum defocus (nm)	2200	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MG, ATP

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	D	0.29	0/3947	0.51	3/5359 (0.1%)
2	B	0.29	0/2350	0.45	0/3214
3	C	0.33	0/2154	0.62	10/2950 (0.3%)
4	A	0.35	1/4071 (0.0%)	0.46	1/5566 (0.0%)
All	All	0.32	1/12522 (0.0%)	0.51	14/17089 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	130	GLN	C-O	-7.32	1.15	1.24

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	C	8	TRP	CA-C-N	7.17	135.24	121.54
3	C	8	TRP	C-N-CA	7.17	135.24	121.54
1	D	361	ARG	CA-C-N	-7.17	110.99	122.24
1	D	361	ARG	C-N-CA	-7.17	110.99	122.24
3	C	7	PHE	CA-C-N	-6.67	111.25	121.66
3	C	7	PHE	C-N-CA	-6.67	111.25	121.66
3	C	8	TRP	N-CA-CB	6.47	120.22	109.60
3	C	8	TRP	N-CA-C	-6.11	100.36	109.15
4	A	184	SER	N-CA-C	-5.59	107.71	114.75
3	C	6	GLY	CA-C-N	-5.57	113.31	123.34
3	C	6	GLY	C-N-CA	-5.57	113.31	123.34
1	D	83	LYS	N-CA-C	-5.27	106.17	113.18
3	C	7	PHE	CA-C-O	-5.24	115.13	121.89
3	C	11	ALA	N-CA-C	-5.08	105.64	111.07

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	D	3892	0	4008	43	0
2	B	2302	0	2443	25	0
3	C	2102	0	2174	24	0
4	A	3962	0	3801	30	0
5	D	62	0	24	1	0
6	D	2	0	0	0	0
All	All	12322	0	12450	117	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.

All (117) 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)
3:C:9:LEU:O	3:C:13:ARG:HG3	1.56	1.05
2:B:41:ASP:OD1	2:B:41:ASP:N	2.08	0.83
4:A:242:ASN:ND2	4:A:538:ILE:O	2.16	0.79
3:C:4:HIS:O	3:C:5:THR:O	2.01	0.78
1:D:383:ASP:OD1	3:C:194:HIS:ND1	2.20	0.71
2:B:291:ASN:ND2	3:C:122:ASP:OD1	2.24	0.71
4:A:214:GLY:O	4:A:216:ALA:N	2.22	0.71
3:C:110:GLY:HA2	3:C:114:ASP:HB2	1.74	0.69
1:D:419:ALA:O	1:D:439:ARG:NH1	2.28	0.66
1:D:155:SER:HB3	1:D:158:MET:HG3	1.76	0.66
1:D:185:ASP:N	1:D:185:ASP:OD1	2.27	0.66
1:D:286:GLU:H	1:D:311:SER:HB3	1.63	0.63
1:D:415:VAL:HG21	1:D:425:LEU:HD11	1.81	0.62
1:D:427:ARG:NH1	1:D:431:GLU:O	2.34	0.61
1:D:433:SER:HB3	1:D:436:GLN:HG3	1.83	0.60
4:A:37:VAL:HG12	4:A:267:VAL:HB	1.84	0.59
1:D:287:LEU:HD13	1:D:336:MET:HE2	1.85	0.59
4:A:33:ASP:OD1	4:A:33:ASP:N	2.34	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:403:ASP:O	1:D:407:ARG:NH2	2.23	0.58
1:D:247:HIS:HD2	1:D:249:TYR:H	1.52	0.57
1:D:193:LEU:HD13	1:D:216:LEU:HD11	1.85	0.57
3:C:7:PHE:HB3	3:C:10:ASP:HB2	1.86	0.57
1:D:101:MET:HE2	1:D:377:ASN:HB2	1.86	0.56
3:C:9:LEU:O	3:C:13:ARG:CG	2.44	0.55
1:D:390:ARG:HD3	3:C:6:GLY:HA3	1.89	0.55
1:D:401:VAL:HG23	1:D:402:GLY:H	1.71	0.55
2:B:81:ALA:O	2:B:83:SER:N	2.39	0.55
1:D:81:ASP:O	1:D:83:LYS:N	2.40	0.54
3:C:144:THR:HG22	3:C:145:VAL:H	1.73	0.54
3:C:67:ASP:O	3:C:70:GLY:N	2.43	0.52
4:A:68:MET:HE3	4:A:78:LEU:HD23	1.92	0.52
1:D:438:GLN:HE22	1:D:460:SER:N	2.07	0.52
1:D:201:ASP:C	1:D:203:LEU:H	2.18	0.52
1:D:209:LEU:HG	1:D:211:THR:HG23	1.92	0.52
3:C:7:PHE:HD1	3:C:10:ASP:HB2	1.75	0.51
3:C:279:ASP:OD1	3:C:279:ASP:N	2.43	0.51
2:B:32:GLY:H	2:B:271:GLN:HE22	1.57	0.51
2:B:205:ASP:OD1	2:B:208:ARG:NH1	2.44	0.50
3:C:4:HIS:C	3:C:5:THR:O	2.54	0.50
4:A:224:VAL:HG12	4:A:225:ARG:HG2	1.94	0.50
2:B:63:LEU:HA	2:B:66:TYR:HB3	1.93	0.50
1:D:489:SER:HB3	1:D:495:ILE:HD11	1.94	0.50
1:D:433:SER:OG	5:D:601:ATP:O2G	2.30	0.49
4:A:79:GLU:OE2	4:A:234:TYR:OH	2.29	0.49
1:D:438:GLN:HE22	1:D:460:SER:H	1.60	0.49
2:B:222:THR:O	2:B:226:LEU:HB3	2.12	0.49
3:C:125:LEU:HD13	3:C:158:PRO:HB2	1.93	0.49
2:B:1:MET:HE2	2:B:3:TRP:HB2	1.94	0.49
3:C:2:ALA:HB2	3:C:196:LEU:HD12	1.94	0.49
2:B:81:ALA:HB3	2:B:85:LEU:O	2.12	0.49
1:D:196:LEU:O	1:D:200:THR:HG23	2.13	0.49
4:A:225:ARG:HH11	4:A:246:ARG:HD3	1.77	0.49
4:A:297:THR:HG22	4:A:508:PRO:HA	1.95	0.49
2:B:215:LEU:HB2	2:B:220:VAL:HG23	1.95	0.49
4:A:142:VAL:HG12	4:A:151:ARG:O	2.13	0.48
1:D:130:ARG:NH2	1:D:133:GLU:OE1	2.46	0.48
1:D:512:GLU:OE1	1:D:528:THR:HG21	2.14	0.47
4:A:58:ARG:HG3	4:A:59:ILE:HD12	1.97	0.47
4:A:162:ASP:N	4:A:162:ASP:OD1	2.47	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:125:ARG:HE	1:D:128:ARG:HD2	1.80	0.47
1:D:281:ILE:HD11	1:D:484:THR:HG21	1.97	0.47
2:B:59:ASP:OD1	2:B:59:ASP:N	2.47	0.47
2:B:148:GLY:HA3	2:B:254:ILE:HD13	1.96	0.47
4:A:446:TYR:CZ	4:A:451:GLU:HG3	2.49	0.46
1:D:15:GLU:HB3	1:D:66:THR:O	2.15	0.46
1:D:525:HIS:HB3	1:D:528:THR:HG22	1.97	0.46
4:A:58:ARG:O	4:A:62:ARG:HG2	2.15	0.46
4:A:311:GLU:OE2	4:A:315:ARG:NH2	2.43	0.46
2:B:188:ALA:O	2:B:192:ARG:HG3	2.16	0.46
1:D:43:GLU:HG2	1:D:44:SER:H	1.80	0.46
1:D:401:VAL:HG23	1:D:402:GLY:N	2.31	0.46
4:A:346:ARG:HG3	4:A:351:PHE:CE2	2.51	0.46
4:A:260:LEU:HD22	4:A:268:LEU:HB2	1.99	0.45
4:A:385:TYR:O	4:A:414:ALA:HA	2.17	0.45
1:D:319:THR:HG23	1:D:485:TYR:HB2	1.98	0.45
4:A:343:PHE:HB2	4:A:497:GLN:HE21	1.81	0.45
2:B:134:VAL:HA	2:B:137:LEU:HG	2.00	0.44
4:A:461:ALA:HB3	4:A:464:ASN:HB2	2.00	0.44
3:C:88:GLY:O	3:C:92:THR:OG1	2.32	0.44
3:C:18:ARG:O	3:C:22:VAL:HG23	2.18	0.44
4:A:214:GLY:N	4:A:215:PRO:HD3	2.32	0.44
1:D:8:LEU:HB2	1:D:34:SER:HB3	2.00	0.44
1:D:383:ASP:O	1:D:385:MET:N	2.51	0.44
3:C:7:PHE:CD1	3:C:10:ASP:HB2	2.52	0.43
3:C:171:VAL:HG21	3:C:199:ALA:HB2	2.00	0.43
4:A:31:SER:HB2	4:A:34:VAL:HG22	1.98	0.43
1:D:247:HIS:CD2	1:D:249:TYR:H	2.34	0.43
2:B:73:ILE:HA	2:B:76:GLY:O	2.18	0.43
2:B:144:ILE:HD12	2:B:147:LEU:HD12	1.99	0.43
4:A:269:ASP:HA	4:A:516:VAL:HG22	2.00	0.43
3:C:196:LEU:HD23	3:C:196:LEU:HA	1.85	0.42
2:B:133:LEU:HD11	2:B:192:ARG:HE	1.84	0.42
2:B:223:VAL:O	2:B:227:ARG:HB2	2.19	0.42
2:B:44:LEU:HD21	4:A:128:LEU:HD22	2.00	0.42
1:D:160:GLN:HE22	1:D:183:ALA:H	1.67	0.42
2:B:16:PHE:O	2:B:20:THR:HG23	2.20	0.42
2:B:166:VAL:CG2	2:B:257:ILE:HG12	2.50	0.41
4:A:343:PHE:H	4:A:497:GLN:NE2	2.18	0.41
1:D:186:VAL:HG23	1:D:187:THR:HG23	2.02	0.41
4:A:62:ARG:NE	4:A:536:GLU:OE1	2.40	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:343:PHE:H	4:A:497:GLN:HE21	1.68	0.41
1:D:403:ASP:OD1	1:D:403:ASP:N	2.51	0.41
3:C:30:LEU:O	3:C:34:VAL:HG23	2.20	0.41
2:B:112:LEU:HD22	2:B:116:PHE:HE1	1.85	0.41
2:B:129:ASP:O	2:B:133:LEU:HD23	2.21	0.41
2:B:235:THR:OG1	2:B:298:TYR:OH	2.16	0.41
1:D:193:LEU:O	1:D:197:GLN:HG2	2.21	0.41
3:C:259:ALA:O	3:C:263:THR:HG23	2.21	0.41
4:A:235:HIS:HA	4:A:239:LYS:HE2	2.03	0.41
2:B:297:LEU:HD12	2:B:297:LEU:HA	1.89	0.40
4:A:314:LEU:HD13	4:A:374:GLN:HG3	2.03	0.40
1:D:10:SER:HB2	1:D:71:VAL:HG13	2.02	0.40
3:C:115:ALA:O	3:C:119:ARG:HG2	2.21	0.40
3:C:226:VAL:HG13	4:A:420:PRO:HG3	2.03	0.40
1:D:15:GLU:OE1	1:D:66:THR:OG1	2.40	0.40
1:D:14:LEU:HD11	1:D:65:ILE:HD13	2.04	0.40
1:D:189:GLN:HE21	1:D:216:LEU:HD13	1.85	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 PDB entries followed by that with respect to all EM entries.

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	D	509/548 (93%)	453 (89%)	53 (10%)	3 (1%)	22	40
2	B	306/308 (99%)	281 (92%)	24 (8%)	1 (0%)	37	55
3	C	279/287 (97%)	260 (93%)	17 (6%)	2 (1%)	19	36
4	A	515/517 (100%)	481 (93%)	33 (6%)	1 (0%)	44	63
All	All	1609/1660 (97%)	1475 (92%)	127 (8%)	7 (0%)	32	49

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	C	5	THR
1	D	361	ARG
2	B	82	TYR
3	C	9	LEU
1	D	185	ASP
1	D	110	VAL
4	A	253	LEU

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 PDB entries followed by that with respect to all EM entries.

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	D	408/435 (94%)	406 (100%)	2 (0%)	86 94
2	B	237/237 (100%)	236 (100%)	1 (0%)	89 95
3	C	210/214 (98%)	207 (99%)	3 (1%)	62 82
4	A	412/413 (100%)	411 (100%)	1 (0%)	92 97
All	All	1267/1299 (98%)	1260 (99%)	7 (1%)	82 92

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	326	SER
1	D	361	ARG
2	B	41	ASP
3	C	5	THR
3	C	8	TRP
3	C	9	LEU
4	A	269	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (30) such sidechains are listed below:

Mol	Chain	Res	Type
1	D	153	GLN
1	D	160	GLN
1	D	189	GLN

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Mol	Chain	Res	Type
1	D	212	HIS
1	D	246	GLN
1	D	247	HIS
1	D	342	GLN
1	D	363	GLN
1	D	377	ASN
1	D	399	HIS
1	D	438	GLN
1	D	469	GLN
1	D	478	GLN
1	D	513	HIS
2	B	65	GLN
2	B	271	GLN
3	C	69	GLN
3	C	71	HIS
3	C	189	GLN
4	A	111	HIS
4	A	161	ASN
4	A	182	HIS
4	A	235	HIS
4	A	242	ASN
4	A	252	ASN
4	A	306	HIS
4	A	404	ASN
4	A	408	ASN
4	A	428	GLN
4	A	497	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 oligosaccharides in this entry.

5.6 Ligand geometry (i)

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 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	$\#\|Z\| > 2$
5	ATP	D	602	6	26,33,33	0.95	1 (3%)	31,52,52	1.41	5 (16%)
5	ATP	D	601	6	26,33,33	0.93	1 (3%)	31,52,52	1.45	5 (16%)

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
5	ATP	D	602	6	-	5/18/38/38	0/3/3/3
5	ATP	D	601	6	-	5/18/38/38	0/3/3/3

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	D	602	ATP	C5-C4	2.19	1.46	1.40
5	D	601	ATP	C5-C4	2.19	1.46	1.40

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	D	601	ATP	N3-C2-N1	-3.36	123.42	128.68
5	D	601	ATP	PA-O3A-PB	-3.36	121.30	132.83
5	D	602	ATP	N3-C2-N1	-3.19	123.70	128.68
5	D	601	ATP	C3'-C2'-C1'	2.86	105.28	100.98
5	D	602	ATP	C4-C5-N7	-2.66	106.63	109.40
5	D	601	ATP	C4-C5-N7	-2.60	106.69	109.40
5	D	602	ATP	C3'-C2'-C1'	2.47	104.70	100.98
5	D	602	ATP	PA-O3A-PB	-2.43	124.48	132.83
5	D	602	ATP	PB-O3B-PG	-2.42	124.51	132.83

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	D	601	ATP	PB-O3B-PG	-2.18	125.35	132.83

There are no chirality outliers.

All (10) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	D	602	ATP	C5'-O5'-PA-O2A
5	D	601	ATP	PB-O3B-PG-O1G
5	D	601	ATP	PB-O3B-PG-O2G
5	D	601	ATP	PB-O3B-PG-O3G
5	D	602	ATP	C5'-O5'-PA-O3A
5	D	601	ATP	PA-O3A-PB-O2B
5	D	602	ATP	PA-O3A-PB-O2B
5	D	601	ATP	C5'-O5'-PA-O1A
5	D	602	ATP	C5'-O5'-PA-O1A
5	D	602	ATP	O4'-C4'-C5'-O5'

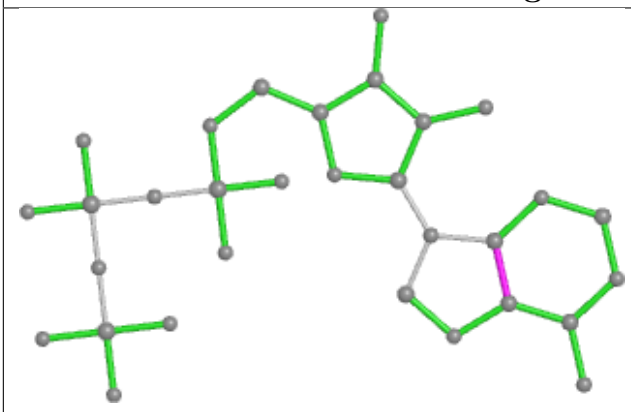
There are no ring outliers.

1 monomer is involved in 1 short contact:

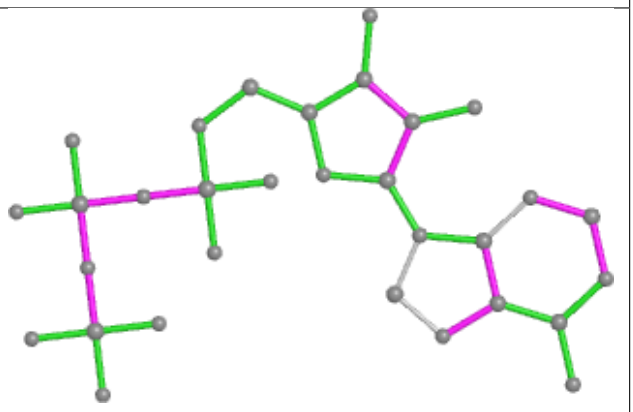
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	D	601	ATP	1	0

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 then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

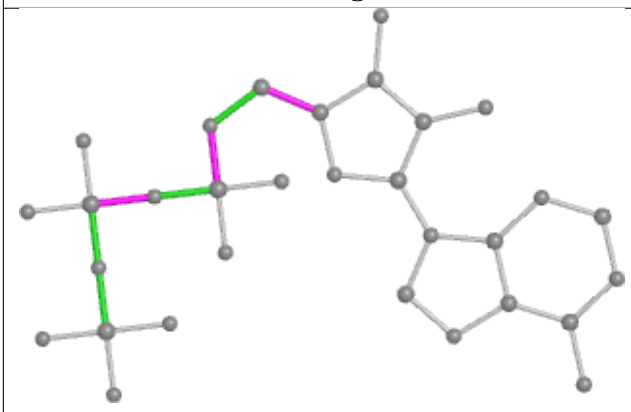
Ligand ATP D 602



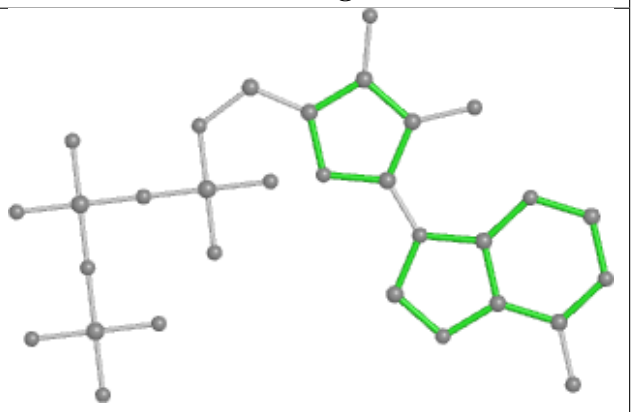
Bond lengths



Bond angles

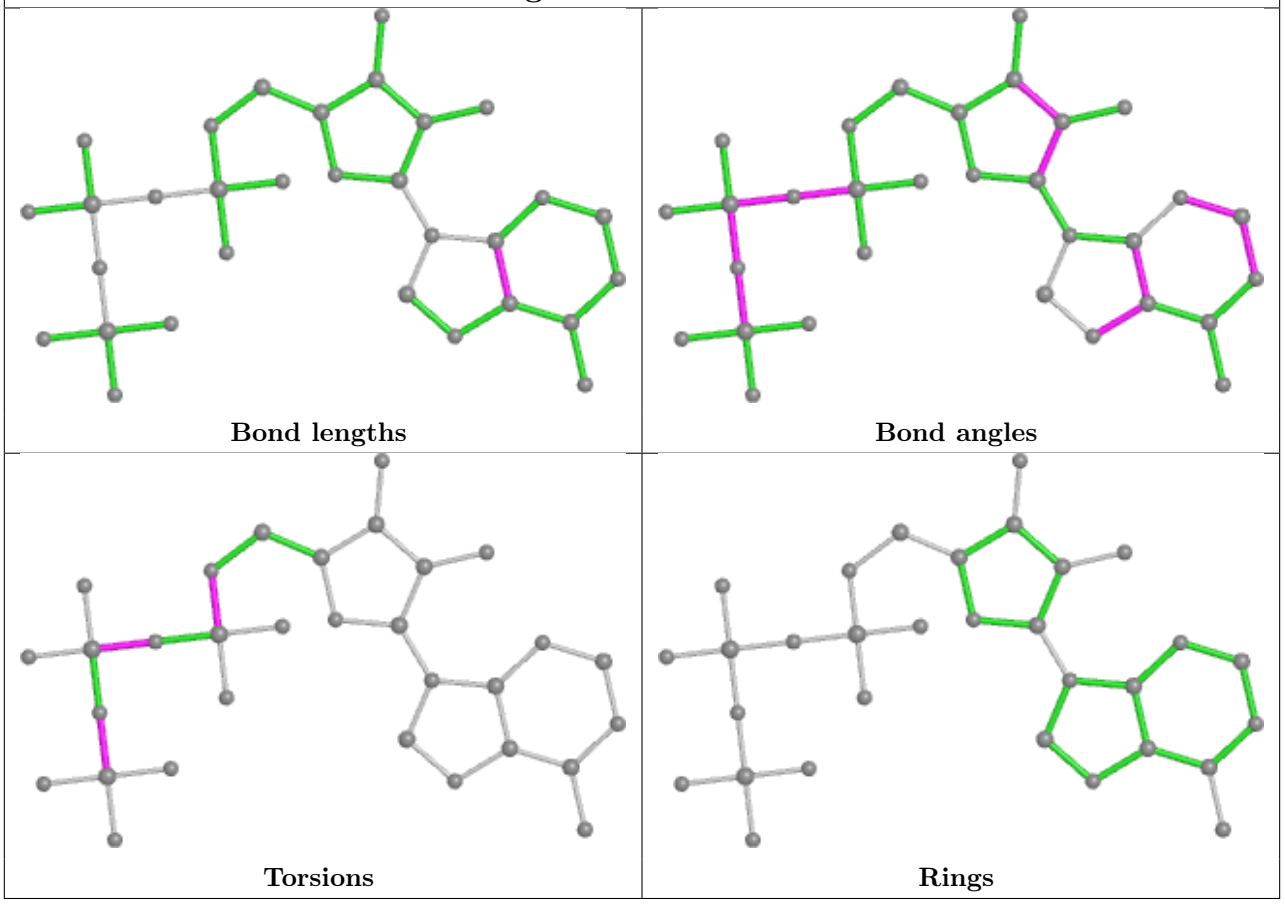


Torsions



Rings

Ligand ATP D 601



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.