Full wwPDB X-ray Structure Validation Report ⓘ

Jun 14, 2020 – 04:04 am BST

PDB ID	:	1K9S
Title	:	PURINE NUCLEOSIDE PHOSPHORYLASE FROM E. COLI IN COMPLEX WITH FORMYCIN A DERIVATIVE AND PHOSPHATE
Authors	:	Koellner, G.; Bzowska, A.; Wielgus-Kutrowska, B.; Luic, M.; Steiner, T.; Saenger, W.; Stepinski, J.
Deposited on	:	2001-10-30
Resolution	:	2.00 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 following versions of software and data (see references ①) were used in the production of this report:

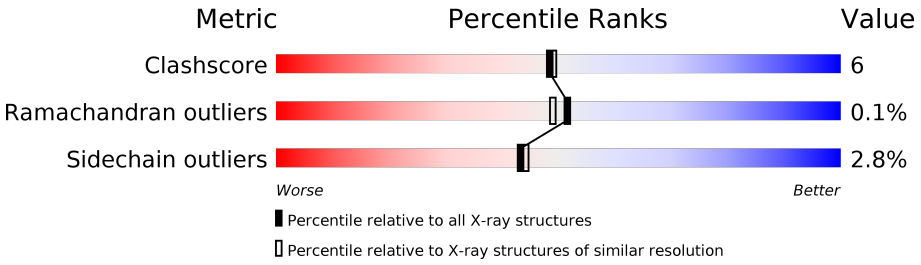
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 2.00 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))
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	237	93% 5% •
1	B	237	92% 7% •
1	C	237	92% 7% •
1	D	237	88% 10% •
1	E	237	89% 11% •
1	F	237	89% 11%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	PO4	D	9908	-	-	X	-
2	PO4	E	9910	-	-	X	-

2 Entry composition

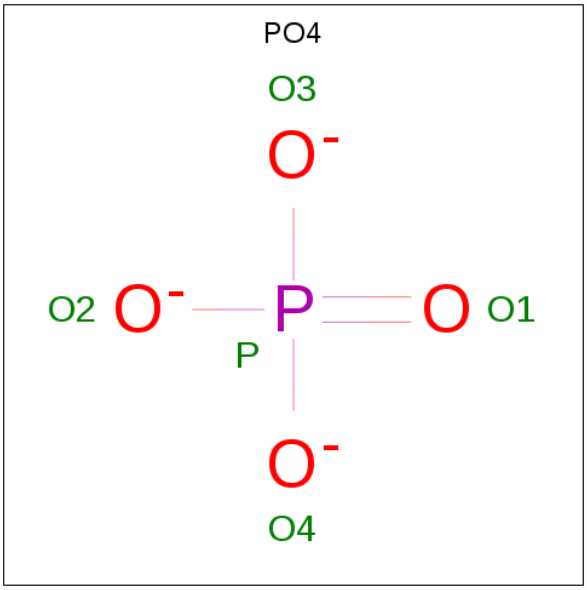
There are 5 unique types of molecules in this entry. The entry contains 12277 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 PURINE NUCLEOSIDE PHOSPHORYLASE.

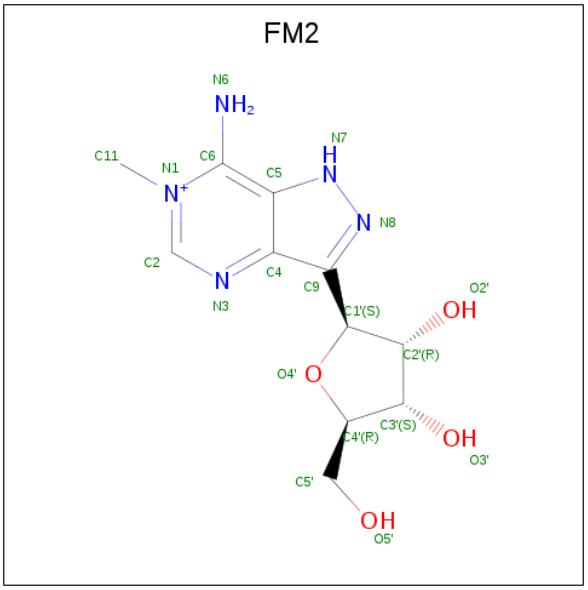
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	237	Total	C	N	O	S	0	3	0
			1824	1150	314	344	16			
1	B	237	Total	C	N	O	S	0	3	0
			1822	1149	313	344	16			
1	C	237	Total	C	N	O	S	0	3	0
			1824	1150	314	344	16			
1	D	237	Total	C	N	O	S	0	3	0
			1805	1142	309	338	16			
1	E	237	Total	C	N	O	S	0	3	0
			1809	1144	310	339	16			
1	F	237	Total	C	N	O	S	0	3	0
			1806	1141	308	341	16			

- Molecule 2 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).



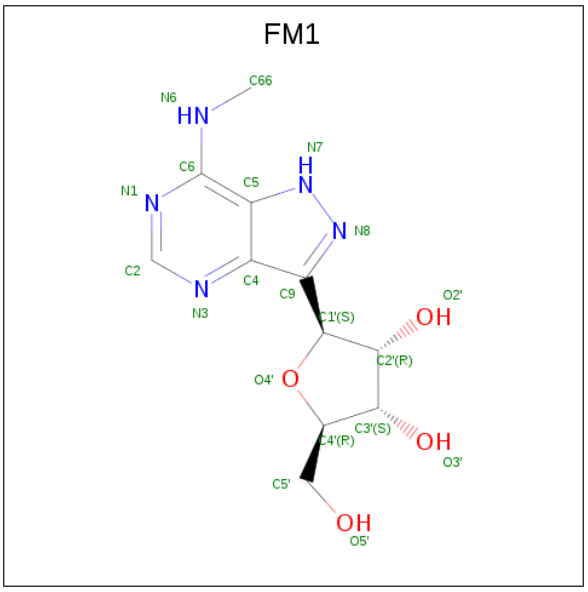
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total O P 5 4 1	0	0
2	B	1	Total O P 5 4 1	0	0
2	C	1	Total O P 5 4 1	0	0
2	D	1	Total O P 5 4 1	0	0
2	E	1	Total O P 5 4 1	0	0
2	F	1	Total O P 5 4 1	0	0

- Molecule 3 is 2-(7-AMINO-6-METHYL-3H-PYRAZOLO[4,3-D]PYRIMIDIN-3-YL)-5-HYDROXYMETHYL-TETRAHYDRO-FURAN-3,4-DIOL (three-letter code: FM2) (formula: $C_{11}H_{16}N_5O_4$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C N O 20 11 5 4	0	0
3	B	1	Total C N O 20 11 5 4	0	0
3	C	1	Total C N O 20 11 5 4	0	0

- Molecule 4 is 2-HYDROXYMETHYL-5-(7-METHYLAMINO-3H-PYRAZOLO[4,3-D]PYRIMIDIN-3-YL)-TETRAHYDRO-FURAN-3,4-DIOL (three-letter code: FM1) (formula: $C_{11}H_{15}N_5O_4$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	D	1	Total C N O 20 11 5 4	0	0
4	E	1	Total C N O 20 11 5 4	0	0
4	F	1	Total C N O 19 10 5 4	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	228	Total O 228 228	0	0
5	B	238	Total O 238 238	0	0
5	C	217	Total O 217 217	0	0
5	D	200	Total O 200 200	0	0
5	E	194	Total O 194 194	0	0
5	F	161	Total O 161 161	0	0

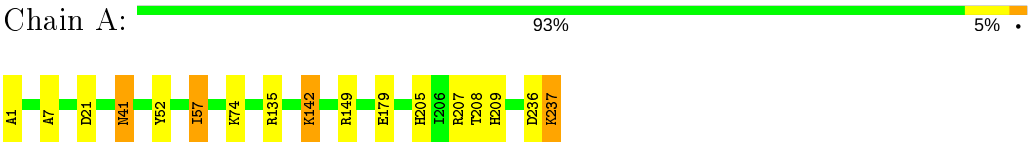
3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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.

Note EDS was not executed.

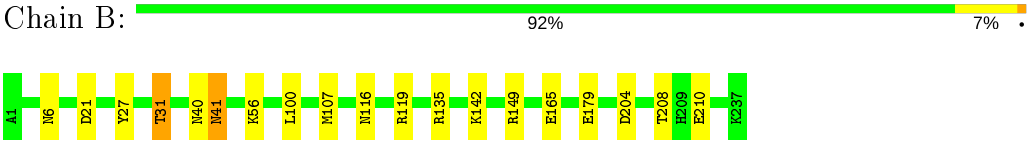
- Molecule 1: PURINE NUCLEOSIDE PHOSPHORYLASE

Chain A:



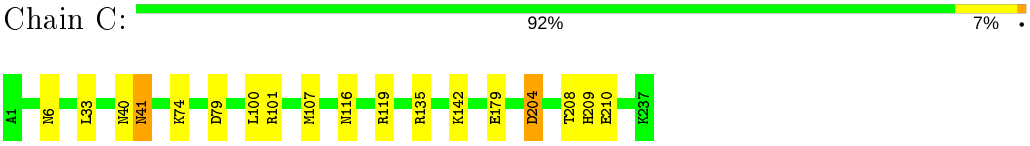
- Molecule 1: PURINE NUCLEOSIDE PHOSPHORYLASE

Chain B:



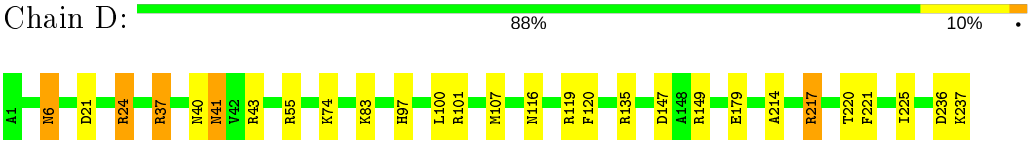
- Molecule 1: PURINE NUCLEOSIDE PHOSPHORYLASE

Chain C:



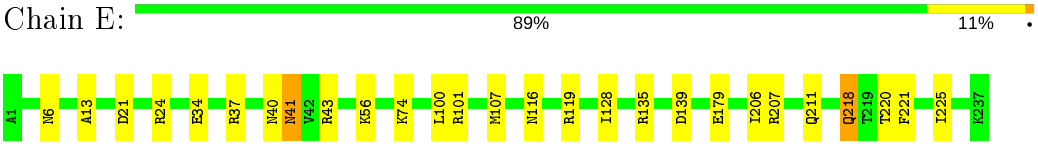
- Molecule 1: PURINE NUCLEOSIDE PHOSPHORYLASE

Chain D:



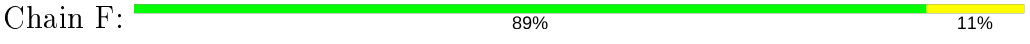
- Molecule 1: PURINE NUCLEOSIDE PHOSPHORYLASE

Chain E:



- Molecule 1: PURINE NUCLEOSIDE PHOSPHORYLASE

Chain F:




A1
N6
R24
A25
K26
E30
R37
N41
V88
L100
D132
R135
I146
D147
E165
E179
T212
T213
A214
A215
E216
R217
Q218
F221
N222
D223
M224
I225
D236
K237

4 Data and refinement statistics (i)

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α, β, γ	178.78Å 178.78Å 167.94Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.95 – 2.00	Depositor
% Data completeness (in resolution range)	98.2 (19.95-2.00)	Depositor
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.161 , 0.184	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	12277	wwPDB-VP
Average B, all atoms (Å^2)	24.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: PO4, FM2, FM1

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	0.49	0/1853	0.71	0/2496
1	B	0.49	0/1851	0.71	0/2494
1	C	0.49	0/1853	0.71	0/2496
1	D	0.49	0/1834	0.72	2/2473 (0.1%)
1	E	0.47	0/1838	0.70	0/2478
1	F	0.46	0/1835	0.68	0/2476
All	All	0.48	0/11064	0.71	2/14913 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	24	ARG	NE-CZ-NH1	6.27	123.44	120.30
1	D	24	ARG	NE-CZ-NH2	-5.34	117.63	120.30

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	1824	0	1825	18	0
1	B	1822	0	1818	16	0
1	C	1824	0	1825	25	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	1805	0	1797	23	0
1	E	1809	0	1803	37	0
1	F	1806	0	1790	26	0
2	A	5	0	0	0	0
2	B	5	0	0	0	0
2	C	5	0	0	0	0
2	D	5	0	0	2	0
2	E	5	0	0	3	0
2	F	5	0	0	0	0
3	A	20	0	16	0	0
3	B	20	0	16	0	0
3	C	20	0	16	0	0
4	D	20	0	15	0	0
4	E	20	0	15	2	0
4	F	19	0	11	0	0
5	A	228	0	0	3	0
5	B	238	0	0	5	0
5	C	217	0	0	2	0
5	D	200	0	0	7	0
5	E	194	0	0	4	0
5	F	161	0	0	3	0
All	All	12277	0	10947	131	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 6.

All (131) 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:C:135:ARG:HH11	1:E:135[A]:ARG:NH2	1.61	0.99
1:A:52:TYR:CB	1:A:57:ILE:HD11	1.95	0.97
1:A:52:TYR:HB3	1:A:57:ILE:HD11	1.47	0.96
1:F:213:THR:HB	1:F:216:GLU:HG2	1.52	0.91
1:F:24:ARG:HD3	1:F:221:PHE:CE1	2.05	0.90
1:E:24:ARG:HH22	2:E:9910:PO4:P	1.97	0.87
1:D:21:ASP:HB3	1:D:24:ARG:HG3	1.61	0.82
1:B:56:LYS:HE3	5:B:1129:HOH:O	1.80	0.80
1:F:236:ASP:O	1:F:237:LYS:HB2	1.80	0.79
1:D:149:ARG:HD3	5:D:1058:HOH:O	1.81	0.79
1:B:27:TYR:O	1:B:31:THR:HG23	1.83	0.78
1:A:52:TYR:HB2	1:A:57:ILE:HD11	1.69	0.75

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:212:THR:CG2	1:F:216:GLU:HG3	2.17	0.74
1:E:218:GLN:NE2	1:E:218:GLN:HA	2.04	0.72
1:C:107[A]:MET:HE3	1:E:128:ILE:HD12	1.72	0.72
1:F:213:THR:HG22	1:F:215:ALA:H	1.55	0.72
1:A:1:ALA:HB1	5:A:1068:HOH:O	1.90	0.69
1:D:6:ASN:HB3	5:D:1028:HOH:O	1.92	0.68
1:E:218:GLN:HA	1:E:218:GLN:HE21	1.58	0.67
1:C:135:ARG:HH11	1:E:135[A]:ARG:HH21	1.42	0.67
1:F:135[A]:ARG:NH1	5:F:1051:HOH:O	2.29	0.65
1:E:218:GLN:CA	1:E:218:GLN:HE21	2.10	0.64
1:F:214:ALA:O	1:F:217:ARG:HG2	1.97	0.63
1:E:221:PHE:O	1:E:225:ILE:HG12	1.99	0.62
1:C:135:ARG:NH1	1:E:135[A]:ARG:NH2	2.41	0.62
1:C:41:ASN:C	1:C:41:ASN:HD22	2.03	0.61
1:D:221:PHE:O	1:D:225:ILE:HG12	2.00	0.61
1:E:6:ASN:H	1:E:40:ASN:ND2	1.99	0.60
1:C:107[A]:MET:CE	1:E:128:ILE:HD12	2.31	0.60
1:B:142:LYS:HE3	5:B:1067:HOH:O	2.00	0.60
1:E:206:ILE:HD11	4:E:9909:FM1:H661	1.82	0.60
1:F:132:ASP:OD1	1:F:135[A]:ARG:NH1	2.35	0.60
1:F:212:THR:HG23	1:F:216:GLU:HG3	1.83	0.60
1:E:101:ARG:HG2	1:E:220:THR:HG21	1.82	0.59
1:D:37:ARG:NH1	5:D:1083:HOH:O	2.33	0.59
1:F:6:ASN:ND2	5:F:1037:HOH:O	2.35	0.59
1:A:236:ASP:O	1:A:237:LYS:HB2	2.03	0.58
1:E:207:ARG:HG3	5:E:1042:HOH:O	2.04	0.57
1:C:6:ASN:H	1:C:40:ASN:ND2	2.03	0.56
1:E:24:ARG:NH2	2:E:9910:PO4:P	2.75	0.56
1:F:100:LEU:HB3	1:F:212:THR:OG1	2.06	0.55
1:A:1:ALA:CB	1:A:7:ALA:O	2.54	0.55
1:E:24:ARG:HD2	1:E:221:PHE:CE1	2.42	0.54
1:F:212:THR:HG22	1:F:216:GLU:HG3	1.89	0.54
1:A:41:ASN:C	1:A:41:ASN:HD22	2.11	0.54
1:E:218:GLN:CA	1:E:218:GLN:NE2	2.69	0.54
1:A:1:ALA:HB3	1:A:7:ALA:O	2.08	0.53
1:F:41:ASN:HD22	1:F:41:ASN:C	2.11	0.53
1:E:24:ARG:NH2	2:E:9910:PO4:O1	2.41	0.52
1:B:149:ARG:HD3	5:B:1023:HOH:O	2.09	0.51
1:F:214:ALA:HA	1:F:217:ARG:HD3	1.91	0.51
1:F:146:ILE:HD13	1:F:223:ASP:HB3	1.91	0.51
1:A:149:ARG:HD3	5:A:1112:HOH:O	2.10	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:6:ASN:H	1:B:40:ASN:ND2	2.09	0.51
1:D:236:ASP:O	1:D:237:LYS:HB2	2.10	0.51
1:F:26:LYS:HE2	1:F:30:GLU:OE2	2.11	0.51
1:B:107[B]:MET:HE2	1:D:107[B]:MET:CE	2.41	0.51
1:A:52:TYR:HB3	1:A:57:ILE:CD1	2.30	0.51
1:B:27:TYR:CE1	1:B:31:THR:HG21	2.47	0.50
1:F:221:PHE:O	1:F:225:ILE:HG12	2.10	0.50
1:E:6:ASN:HB3	5:E:1014:HOH:O	2.11	0.50
1:A:236:ASP:O	1:A:237:LYS:CB	2.60	0.49
1:C:107[B]:MET:SD	1:E:107[B]:MET:SD	3.11	0.49
1:C:135:ARG:HD2	1:E:135[A]:ARG:CZ	2.42	0.49
1:D:100:LEU:O	1:D:101:ARG:HB2	2.13	0.49
1:C:208:THR:OG1	1:C:210:GLU:HG3	2.12	0.49
1:A:142:LYS:HD2	1:A:142:LYS:O	2.13	0.49
1:E:206:ILE:HD11	4:E:9909:FM1:C66	2.42	0.49
1:E:41:ASN:C	1:E:41:ASN:HD22	2.17	0.48
1:E:6:ASN:H	1:E:40:ASN:HD22	1.59	0.48
1:C:135:ARG:NH1	1:E:135[A]:ARG:HH21	2.08	0.48
1:C:6:ASN:HB3	5:C:9998:HOH:O	2.14	0.48
1:F:100:LEU:HD22	1:F:212:THR:OG1	2.13	0.48
1:C:135:ARG:CD	1:E:135[A]:ARG:CZ	2.92	0.47
1:C:100:LEU:O	1:C:101[B]:ARG:HB2	2.15	0.47
1:F:100:LEU:HD13	1:F:212:THR:HA	1.95	0.47
1:D:135[A]:ARG:HG2	1:D:135[A]:ARG:HH11	1.80	0.47
1:C:100:LEU:O	1:C:101[A]:ARG:HB2	2.15	0.47
1:E:100:LEU:O	1:E:101:ARG:HB2	2.15	0.46
1:F:24:ARG:CD	1:F:221:PHE:CE1	2.89	0.46
1:F:213:THR:CB	1:F:216:GLU:HG2	2.37	0.46
1:D:101:ARG:O	1:D:220:THR:HG21	2.15	0.46
1:D:83:LYS:HE3	5:D:1026:HOH:O	2.14	0.46
1:C:142:LYS:HB2	1:C:142:LYS:HE3	1.62	0.46
1:F:236:ASP:O	1:F:237:LYS:CB	2.60	0.46
1:D:24:ARG:CD	5:D:1061:HOH:O	2.64	0.45
1:D:41:ASN:HD22	1:D:41:ASN:C	2.20	0.45
1:C:74:LYS:HD3	1:C:74:LYS:C	2.37	0.45
1:E:116:ASN:ND2	1:E:119:ARG:HH11	2.14	0.45
1:E:21:ASP:H	1:E:24:ARG:HH21	1.64	0.45
1:E:135[A]:ARG:NH2	1:E:139:ASP:OD1	2.50	0.45
1:B:107[B]:MET:HE2	1:D:107[B]:MET:HE2	1.99	0.45
1:D:214:ALA:O	1:D:217:ARG:HB3	2.17	0.45
1:E:37:ARG:HG2	5:E:1058:HOH:O	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:21:ASP:HB3	1:E:24:ARG:HE	1.83	0.44
1:B:100:LEU:HD11	1:B:204[B]:ASP:HA	2.00	0.44
1:B:135:ARG:NE	5:B:1021:HOH:O	2.51	0.44
1:C:208:THR:O	1:C:209:HIS:HB2	2.18	0.44
1:D:6:ASN:H	1:D:40:ASN:ND2	2.15	0.43
1:C:135:ARG:HD3	1:E:135[A]:ARG:NE	2.33	0.43
1:F:88:VAL:O	1:F:88:VAL:HG23	2.18	0.43
1:B:208:THR:OG1	1:B:210:GLU:HG3	2.18	0.43
1:C:107[A]:MET:HE3	1:C:107[A]:MET:HB3	1.86	0.43
1:F:135[B]:ARG:NH1	5:F:1051:HOH:O	2.41	0.43
1:A:135:ARG:NH1	5:A:1021:HOH:O	2.51	0.43
1:A:1:ALA:HB2	1:A:7:ALA:O	2.19	0.43
1:D:97:HIS:HB2	5:D:1023:HOH:O	2.19	0.42
1:B:41:ASN:HB2	5:B:1035:HOH:O	2.19	0.42
1:C:100:LEU:HD11	1:C:204[B]:ASP:HA	2.00	0.42
1:A:74:LYS:HD3	1:A:74:LYS:C	2.39	0.42
1:B:41:ASN:HD22	1:B:41:ASN:C	2.21	0.42
1:E:13:ALA:HB2	1:E:56:LYS:HG2	2.02	0.42
1:F:221:PHE:CZ	1:F:225:ILE:HD11	2.54	0.42
1:C:116:ASN:ND2	1:C:119:ARG:HH11	2.17	0.42
1:D:116:ASN:ND2	1:D:119:ARG:HH11	2.17	0.42
1:C:6:ASN:H	1:C:40:ASN:HD22	1.64	0.42
1:D:24:ARG:HH12	2:D:9908:PO4:P	2.43	0.42
1:C:135:ARG:NE	5:C:9911:HOH:O	2.53	0.42
1:E:74:LYS:C	1:E:74:LYS:HD3	2.40	0.42
1:A:205:HIS:CE1	1:A:207:ARG:HB2	2.55	0.42
1:F:218:GLN:HA	1:F:218:GLN:OE1	2.20	0.42
1:A:21:ASP:OD1	1:D:43:ARG:HA	2.20	0.41
1:B:116:ASN:ND2	1:B:119:ARG:HH11	2.18	0.41
1:D:24:ARG:HD2	5:D:1061:HOH:O	2.19	0.41
1:B:21:ASP:OD1	1:E:43:ARG:HA	2.20	0.41
1:A:208:THR:O	1:A:209:HIS:HB2	2.20	0.41
1:B:27:TYR:O	1:B:31:THR:CG2	2.62	0.41
1:D:24:ARG:NH1	2:D:9908:PO4:O4	2.52	0.41
1:C:41:ASN:C	1:C:41:ASN:ND2	2.72	0.40
1:D:74:LYS:C	1:D:74:LYS:HD3	2.41	0.40
1:E:24:ARG:CZ	5:E:1103:HOH:O	2.69	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	238/237 (100%)	233 (98%)	5 (2%)	0	100	100
1	B	238/237 (100%)	233 (98%)	5 (2%)	0	100	100
1	C	238/237 (100%)	232 (98%)	6 (2%)	0	100	100
1	D	238/237 (100%)	230 (97%)	7 (3%)	1 (0%)	34	30
1	E	238/237 (100%)	233 (98%)	5 (2%)	0	100	100
1	F	238/237 (100%)	228 (96%)	10 (4%)	0	100	100
All	All	1428/1422 (100%)	1389 (97%)	38 (3%)	1 (0%)	51	49

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	217	ARG

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	191/188 (102%)	186 (97%)	5 (3%)	46	48
1	B	190/188 (101%)	186 (98%)	4 (2%)	53	57
1	C	191/188 (102%)	185 (97%)	6 (3%)	40	40
1	D	186/188 (99%)	179 (96%)	7 (4%)	33	31
1	E	187/188 (100%)	182 (97%)	5 (3%)	44	46
1	F	187/188 (100%)	182 (97%)	5 (3%)	44	46

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	1132/1128 (100%)	1100 (97%)	32 (3%)	43 44

All (32) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	41	ASN
1	A	57	ILE
1	A	142	LYS
1	A	179	GLU
1	A	237	LYS
1	B	31	THR
1	B	41	ASN
1	B	165	GLU
1	B	179	GLU
1	C	33	LEU
1	C	41	ASN
1	C	79	ASP
1	C	179	GLU
1	C	204[A]	ASP
1	C	204[B]	ASP
1	D	6	ASN
1	D	37	ARG
1	D	41	ASN
1	D	55	ARG
1	D	120	PHE
1	D	147	ASP
1	D	179	GLU
1	E	34	GLU
1	E	41	ASN
1	E	179	GLU
1	E	211	GLN
1	E	218	GLN
1	F	37	ARG
1	F	41	ASN
1	F	147	ASP
1	F	165	GLU
1	F	179	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (28) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	41	ASN
1	A	116	ASN
1	A	211	GLN
1	A	222	ASN
1	B	6	ASN
1	B	40	ASN
1	B	41	ASN
1	B	116	ASN
1	B	222	ASN
1	C	6	ASN
1	C	40	ASN
1	C	41	ASN
1	C	116	ASN
1	C	222	ASN
1	D	6	ASN
1	D	40	ASN
1	D	41	ASN
1	D	116	ASN
1	D	211	GLN
1	E	40	ASN
1	E	41	ASN
1	E	116	ASN
1	E	218	GLN
1	E	222	ASN
1	F	41	ASN
1	F	116	ASN
1	F	211	GLN
1	F	222	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 carbohydrates in this entry.

5.6 Ligand geometry (i)

12 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
3	FM2	B	9903	-	20,22,22	2.08	8 (40%)	15,33,33	1.43	2 (13%)
2	PO4	B	9904	-	4,4,4	0.94	0	6,6,6	1.01	0
4	FM1	E	9909	-	20,22,22	2.90	7 (35%)	17,32,32	3.55	7 (41%)
2	PO4	C	9906	-	4,4,4	0.89	0	6,6,6	0.97	0
4	FM1	F	9911	-	20,21,22	2.11	7 (35%)	19,31,32	2.25	6 (31%)
2	PO4	A	9902	-	4,4,4	1.18	0	6,6,6	1.02	0
4	FM1	D	9907	-	20,22,22	2.89	8 (40%)	17,32,32	3.50	6 (35%)
2	PO4	F	9912	-	4,4,4	1.01	0	6,6,6	0.96	0
3	FM2	C	9905	-	20,22,22	2.03	6 (30%)	15,33,33	1.64	3 (20%)
2	PO4	E	9910	-	4,4,4	1.18	1 (25%)	6,6,6	1.05	0
2	PO4	D	9908	-	4,4,4	1.19	1 (25%)	6,6,6	1.13	0
3	FM2	A	9901	-	20,22,22	2.11	8 (40%)	15,33,33	1.48	2 (13%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	FM1	E	9909	-	-	0/4/24/24	0/3/3/3
4	FM1	F	9911	-	-	0/2/22/24	0/3/3/3
4	FM1	D	9907	-	-	0/4/24/24	0/3/3/3
3	FM2	B	9903	-	-	2/2/22/22	0/3/3/3
3	FM2	C	9905	-	-	2/2/22/22	0/3/3/3
3	FM2	A	9901	-	-	0/2/22/22	0/3/3/3

All (46) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	E	9909	FM1	C6-N1	8.27	1.45	1.34
4	D	9907	FM1	C6-N1	7.90	1.45	1.34
4	D	9907	FM1	C6-N6	-5.03	1.27	1.35
4	E	9909	FM1	C6-N6	-4.92	1.27	1.35
4	D	9907	FM1	C9-N8	4.56	1.40	1.34
4	F	9911	FM1	C2-N1	4.43	1.42	1.33
4	F	9911	FM1	C9-N8	4.39	1.39	1.34
4	E	9909	FM1	C2-N1	4.22	1.41	1.33
3	A	9901	FM2	C6-N1	4.21	1.45	1.36
4	E	9909	FM1	C9-N8	4.12	1.39	1.34
3	B	9903	FM2	C6-N1	4.10	1.45	1.36
4	D	9907	FM1	C2-N1	4.04	1.41	1.33
3	C	9905	FM2	C2-N3	3.82	1.37	1.30
3	B	9903	FM2	C2-N3	3.65	1.37	1.30
3	B	9903	FM2	C9-N8	3.64	1.38	1.34
3	A	9901	FM2	C9-N8	3.62	1.38	1.34
3	C	9905	FM2	C6-N1	3.56	1.44	1.36
3	C	9905	FM2	C9-N8	3.51	1.38	1.34
3	A	9901	FM2	C2-N3	3.45	1.36	1.30
3	A	9901	FM2	N7-N8	-3.44	1.31	1.37
3	B	9903	FM2	N7-N8	-3.37	1.31	1.37
4	F	9911	FM1	C2-N3	3.24	1.37	1.32
3	C	9905	FM2	N7-N8	-3.17	1.31	1.37
4	E	9909	FM1	N7-N8	-3.12	1.31	1.37
4	E	9909	FM1	C2-N3	3.10	1.37	1.32
3	A	9901	FM2	C4-N3	3.01	1.40	1.37
4	D	9907	FM1	C2-N3	2.96	1.36	1.32
4	D	9907	FM1	N7-N8	-2.93	1.32	1.37
4	F	9911	FM1	N7-N8	-2.86	1.32	1.37
4	E	9909	FM1	C9-C4	-2.85	1.38	1.43
3	C	9905	FM2	C9-C4	-2.77	1.38	1.43
3	B	9903	FM2	C6-N6	-2.53	1.25	1.35
3	B	9903	FM2	C2'-C1'	2.47	1.56	1.54
4	D	9907	FM1	C9-C4	-2.47	1.39	1.43
3	A	9901	FM2	C6-N6	-2.42	1.26	1.35
3	C	9905	FM2	C6-N6	-2.41	1.26	1.35
4	F	9911	FM1	C9-C4	-2.27	1.39	1.43
4	F	9911	FM1	C4-N3	2.25	1.39	1.37
2	D	9908	PO4	P-O4	2.20	1.61	1.54
3	A	9901	FM2	C2'-C1'	2.17	1.56	1.54
3	A	9901	FM2	C9-C4	-2.13	1.39	1.43
3	B	9903	FM2	C9-C4	-2.11	1.39	1.43
4	F	9911	FM1	C6-N6	-2.10	1.26	1.34

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	E	9910	PO4	P-O4	2.06	1.60	1.54
4	D	9907	FM1	C4-N3	2.05	1.39	1.37
3	B	9903	FM2	C4-N3	2.03	1.39	1.37

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	D	9907	FM1	C2-N1-C6	10.59	125.67	116.59
4	E	9909	FM1	C2-N1-C6	10.01	125.17	116.59
4	E	9909	FM1	C66-N6-C6	-6.77	117.04	122.87
4	D	9907	FM1	C66-N6-C6	-6.03	117.68	122.87
4	F	9911	FM1	C5-C6-N6	4.82	127.67	120.35
4	E	9909	FM1	N3-C2-N1	-4.48	121.68	128.68
4	E	9909	FM1	C3'-C2'-C1'	4.44	107.06	101.93
4	D	9907	FM1	N3-C2-N1	-4.35	121.88	128.68
4	F	9911	FM1	N3-C2-N1	-4.08	122.31	128.68
4	D	9907	FM1	C3'-C2'-C1'	3.89	106.42	101.93
3	C	9905	FM2	C2-N3-C4	-3.84	113.16	116.76
4	F	9911	FM1	C2-N1-C6	3.67	125.03	118.75
3	A	9901	FM2	C2-N3-C4	-3.56	113.42	116.76
3	B	9903	FM2	C2-N3-C4	-3.41	113.56	116.76
4	F	9911	FM1	C5-C6-N1	-3.37	112.71	120.35
4	F	9911	FM1	C3'-C2'-C1'	3.32	105.76	101.93
4	D	9907	FM1	C5-C4-N3	3.27	128.72	124.92
4	E	9909	FM1	C5-C4-N3	3.17	128.61	124.92
3	C	9905	FM2	C5-C4-N3	3.14	128.57	124.92
3	A	9901	FM2	C5-C4-N3	2.96	128.36	124.92
4	F	9911	FM1	C5-C4-N3	2.91	128.30	124.92
3	B	9903	FM2	C5-C4-N3	2.90	128.29	124.92
3	C	9905	FM2	C3'-C2'-C1'	2.18	104.44	101.93
4	D	9907	FM1	C2-N3-C4	-2.14	113.14	114.81
4	E	9909	FM1	C5'-C4'-C3'	-2.08	110.08	115.09
4	E	9909	FM1	O2'-C2'-C1'	-2.02	107.14	111.94

There are no chirality outliers.

All (4) torsion outliers are listed below:

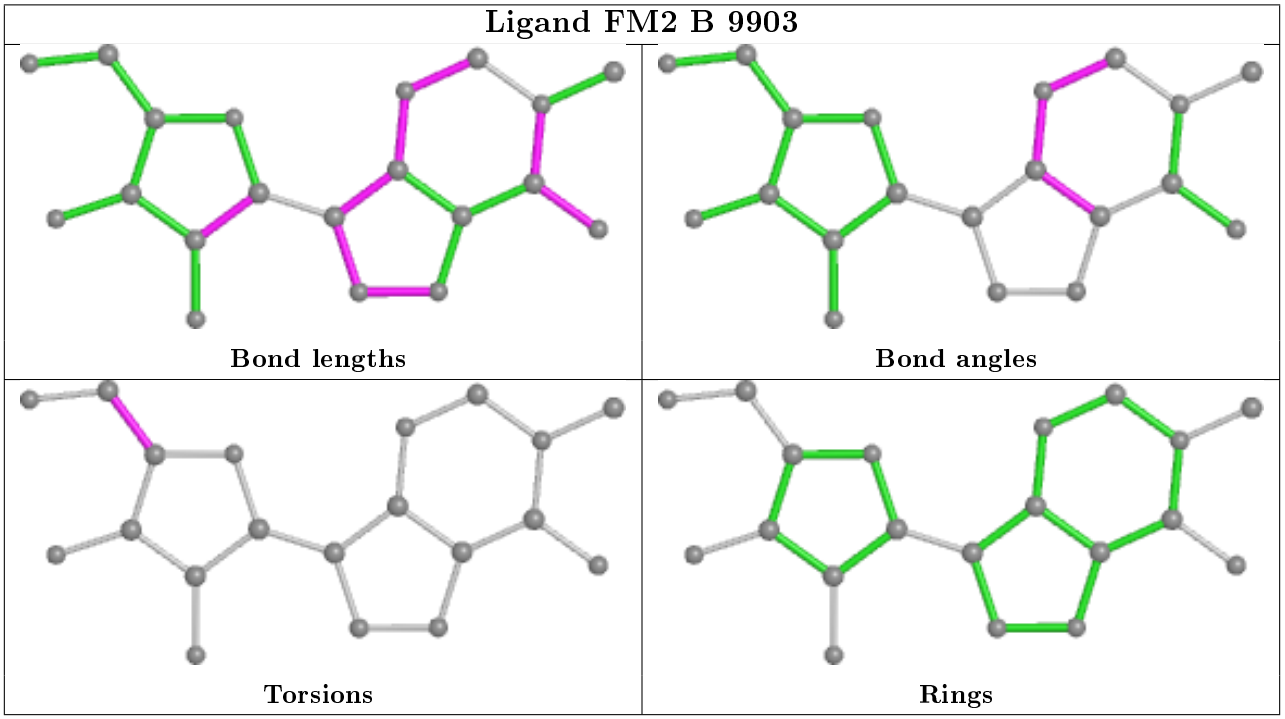
Mol	Chain	Res	Type	Atoms
3	B	9903	FM2	C3'-C4'-C5'-O5'
3	B	9903	FM2	O4'-C4'-C5'-O5'
3	C	9905	FM2	O4'-C4'-C5'-O5'
3	C	9905	FM2	C3'-C4'-C5'-O5'

There are no ring outliers.

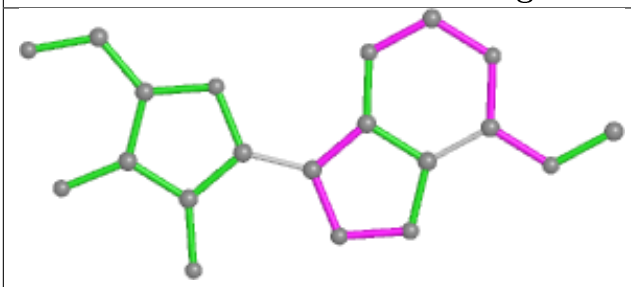
3 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	E	9909	FM1	2	0
2	E	9910	PO4	3	0
2	D	9908	PO4	2	0

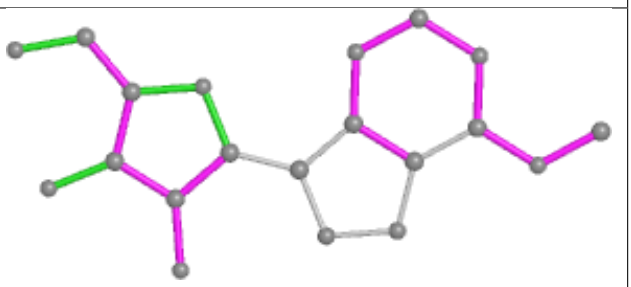
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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



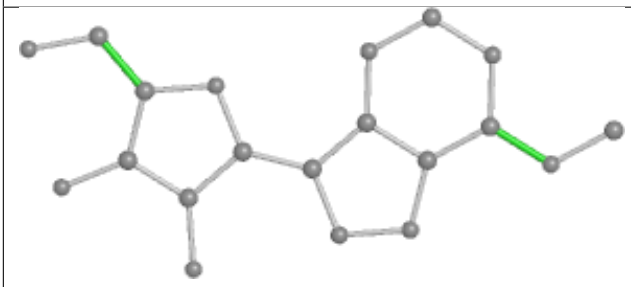
Ligand FM1 E 9909



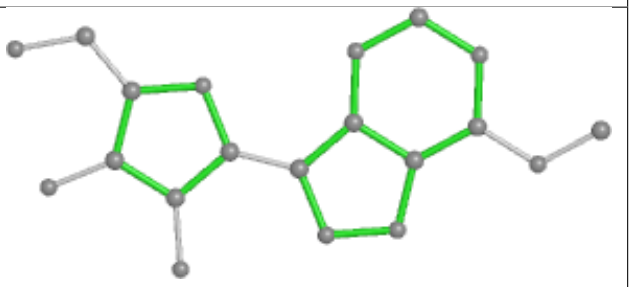
Bond lengths



Bond angles

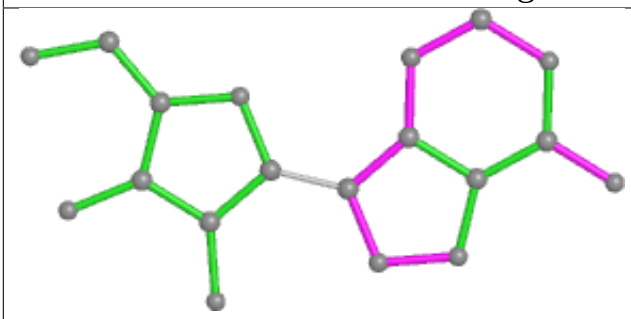


Torsions

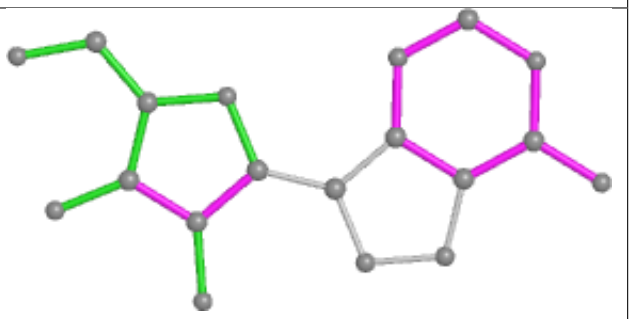


Rings

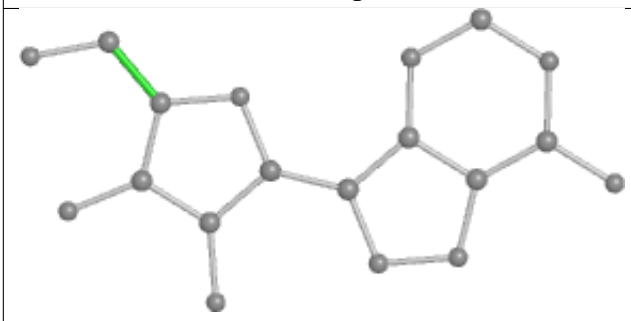
Ligand FM1 F 9911



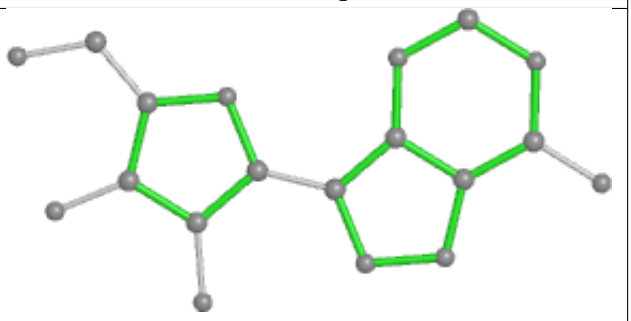
Bond lengths



Bond angles

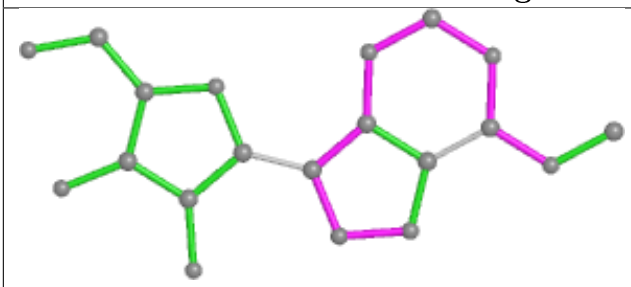


Torsions

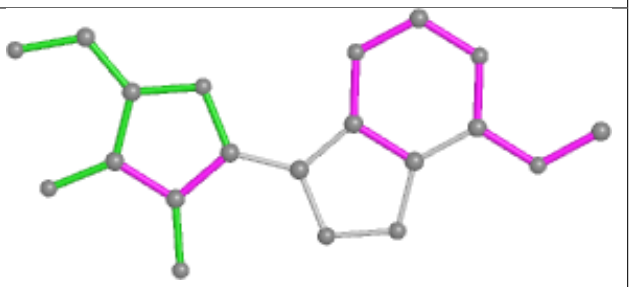


Rings

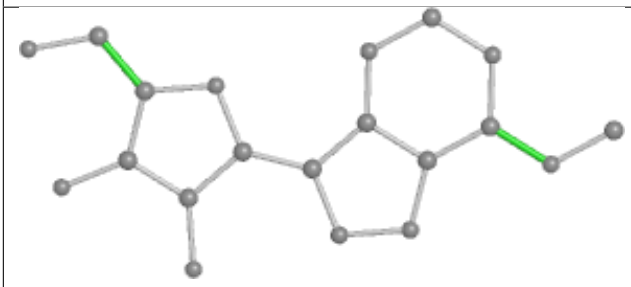
Ligand FM1 D 9907



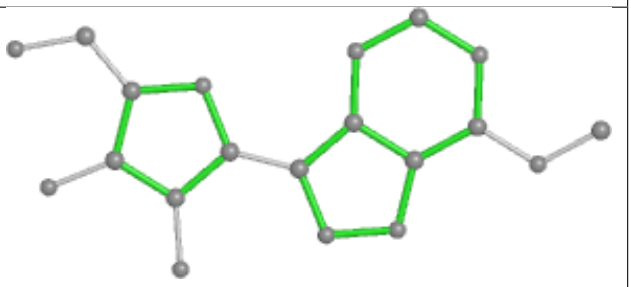
Bond lengths



Bond angles

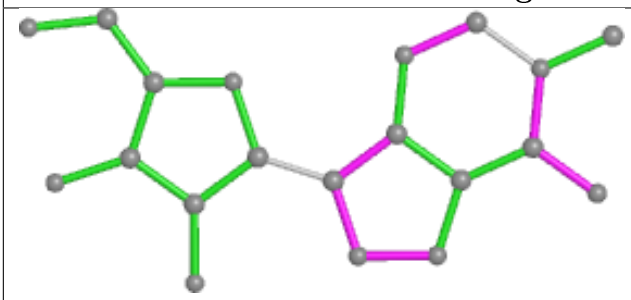


Torsions

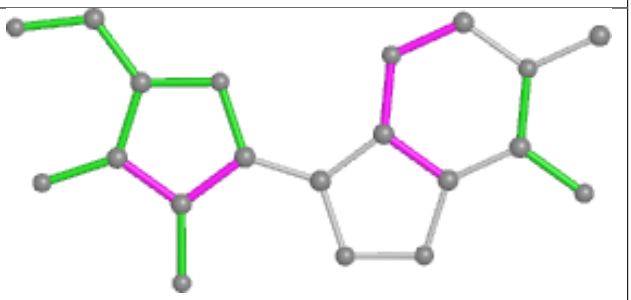


Rings

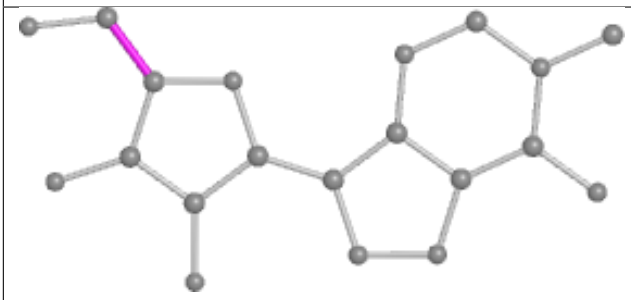
Ligand FM2 C 9905



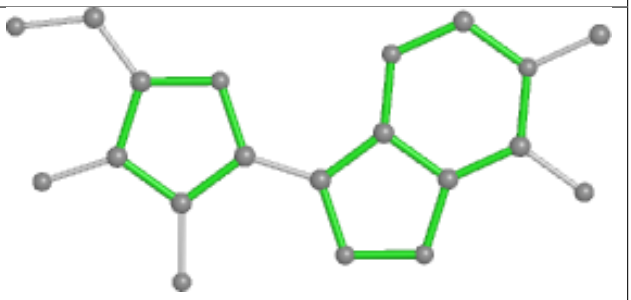
Bond lengths



Bond angles

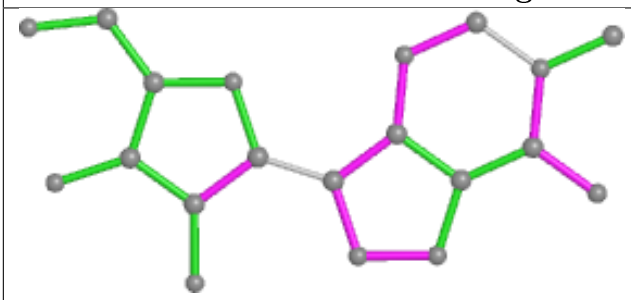


Torsions

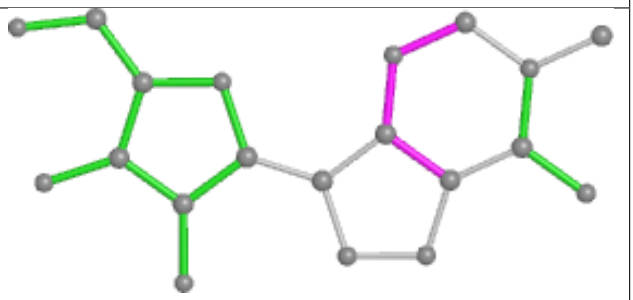


Rings

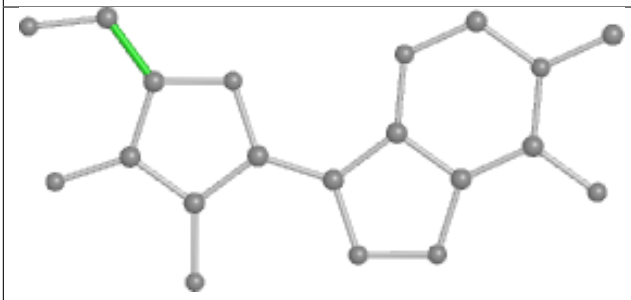
Ligand FM2 A 9901



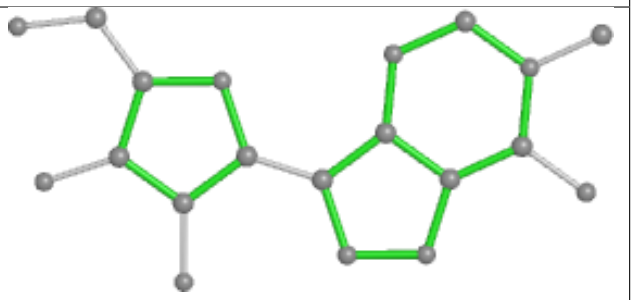
Bond lengths



Bond angles



Torsions



Rings

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

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.