Full wwPDB X-ray Structure Validation Report ⓘ

Jul 26, 2023 – 01:33 AM EDT

PDB ID	:	1AOB
Title	:	E. COLI THYMIDYLATE SYNTHASE COMPLEXED WITH DDURD
Authors	:	Stout, T.J.; Sage, C.R.; Stroud, R.M.
Deposited on	:	1997-06-30
Resolution	:	2.10 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

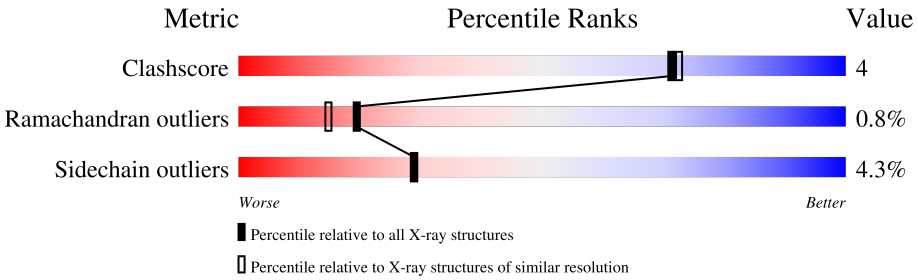
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.34

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 2.10 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	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)

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

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	264	82% 15% .

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	A	300	-	X	-	-

2 Entry composition

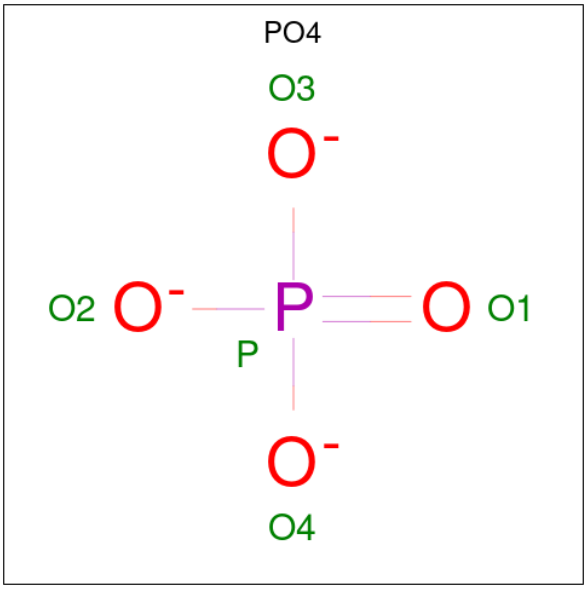
There are 4 unique types of molecules in this entry. The entry contains 2173 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 THYMIDYLATE SYNTHASE.

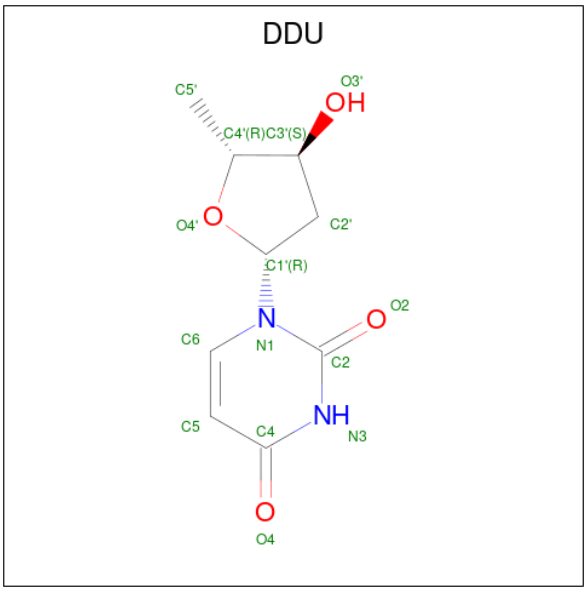
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	264	2150	1374	371	393	12	0	0	0

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



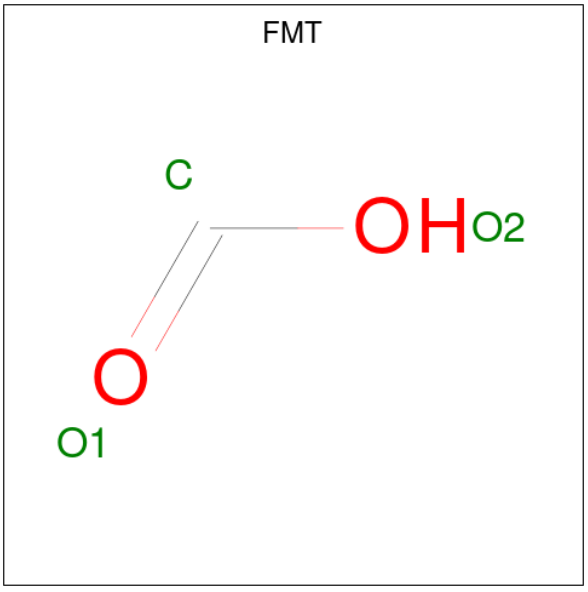
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	P		
2	A	1	5	4	1	0	0

- Molecule 3 is 2'-5'DIDEOXYURIDINE (three-letter code: DDU) (formula: $C_9H_{12}N_2O_4$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C N O 15 9 2 4	0	0

- Molecule 4 is FORMIC ACID (three-letter code: FMT) (formula: CH_2O_2).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 3 1 2	0	0

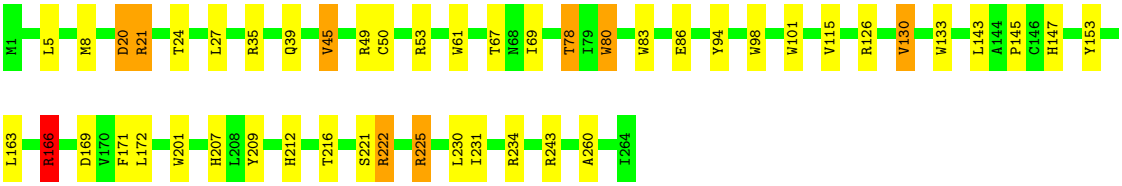
3 Residue-property plots (i)

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. 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: THYMIDYLATE SYNTHASE

Chain A:



4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	I 21 3	Depositor
Cell constants a, b, c, α, β, γ	133.02Å 133.02Å 133.02Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.10	Depositor
% Data completeness (in resolution range)	89.5 (8.00-2.10)	Depositor
R_{merge}	0.10	Depositor
R_{sym}	0.10	Depositor
Refinement program	X-PLOR 3.843	Depositor
R, R_{free}	0.193 , 0.243	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2173	wwPDB-VP
Average B, all atoms (Å^2)	22.0	wwPDB-VP

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: FMT, PO4, DDU

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	0.82	1/2210 (0.0%)	1.53	39/3000 (1.3%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	101	TRP	CD1-NE1	-5.02	1.29	1.38

All (39) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	166	ARG	NE-CZ-NH1	11.15	125.88	120.30
1	A	53	ARG	NE-CZ-NH1	10.29	125.45	120.30
1	A	53	ARG	NE-CZ-NH2	-9.28	115.66	120.30
1	A	80	TRP	CD1-CG-CD2	8.85	113.38	106.30
1	A	83	TRP	CD1-CG-CD2	8.63	113.21	106.30
1	A	133	TRP	CD1-CG-CD2	8.51	113.10	106.30
1	A	166	ARG	NE-CZ-NH2	-8.28	116.16	120.30
1	A	101	TRP	CE2-CD2-CG	-7.73	101.12	107.30
1	A	83	TRP	CE2-CD2-CG	-7.73	101.12	107.30
1	A	98	TRP	CD1-CG-CD2	7.70	112.46	106.30
1	A	201	TRP	CD1-CG-CD2	7.59	112.37	106.30
1	A	49	ARG	NE-CZ-NH1	7.54	124.07	120.30
1	A	80	TRP	CE2-CD2-CG	-7.46	101.33	107.30
1	A	45	VAL	CG1-CB-CG2	-7.39	99.08	110.90
1	A	101	TRP	CD1-CG-CD2	7.39	112.21	106.30
1	A	61	TRP	CD1-CG-CD2	7.02	111.92	106.30
1	A	133	TRP	CE2-CD2-CG	-7.01	101.69	107.30
1	A	98	TRP	CE2-CD2-CG	-6.97	101.72	107.30
1	A	201	TRP	CE2-CD2-CG	-6.92	101.77	107.30
1	A	49	ARG	NE-CZ-NH2	-6.82	116.89	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	61	TRP	CE2-CD2-CG	-6.72	101.92	107.30
1	A	126	ARG	NE-CZ-NH1	6.66	123.63	120.30
1	A	234	ARG	NE-CZ-NH1	6.35	123.47	120.30
1	A	35	ARG	NE-CZ-NH2	-6.33	117.14	120.30
1	A	78	THR	N-CA-CB	-6.09	98.73	110.30
1	A	222	ARG	NE-CZ-NH1	5.93	123.27	120.30
1	A	225	ARG	NE-CZ-NH2	-5.88	117.36	120.30
1	A	221	SER	CB-CA-C	-5.87	98.95	110.10
1	A	169	ASP	CB-CG-OD1	5.80	123.52	118.30
1	A	243	ARG	NE-CZ-NH2	-5.55	117.52	120.30
1	A	101	TRP	CG-CD2-CE3	5.53	138.88	133.90
1	A	230	LEU	CA-CB-CG	5.43	127.79	115.30
1	A	83	TRP	CG-CD1-NE1	-5.38	104.72	110.10
1	A	133	TRP	CG-CD1-NE1	-5.34	104.76	110.10
1	A	21	ARG	NE-CZ-NH1	5.23	122.92	120.30
1	A	153	TYR	CB-CG-CD2	-5.18	117.89	121.00
1	A	83	TRP	CG-CD2-CE3	5.14	138.52	133.90
1	A	201	TRP	CG-CD1-NE1	-5.06	105.04	110.10
1	A	209	TYR	CB-CG-CD2	-5.06	117.97	121.00

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	2150	0	2080	15	0
2	A	5	0	0	0	0
3	A	15	0	12	2	0
4	A	3	0	0	0	0
All	All	2173	0	2092	15	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 4.

All (15) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:69:ILE:HD11	1:A:80:TRP:HB2	1.74	0.70
1:A:207:HIS:NE2	3:A:301:DDU:O3'	2.27	0.66
1:A:147:HIS:HB2	1:A:163:LEU:HD11	1.79	0.65
1:A:115:VAL:HG21	1:A:130:VAL:HG12	1.87	0.57
1:A:69:ILE:HD11	1:A:80:TRP:CB	2.35	0.56
1:A:172:LEU:HD13	1:A:260:ALA:HB3	1.90	0.52
1:A:20:ASP:HB3	1:A:24:THR:O	2.11	0.50
1:A:145:PRO:O	1:A:166:ARG:HD3	2.11	0.50
1:A:45:VAL:CG1	1:A:50:CYS:SG	3.03	0.46
1:A:212:HIS:O	1:A:216:THR:HG23	2.16	0.46
1:A:86:GLU:CD	1:A:86:GLU:H	2.20	0.45
1:A:207:HIS:CE1	3:A:301:DDU:O3'	2.73	0.42
1:A:5:LEU:HD23	1:A:8:MET:CE	2.50	0.41
1:A:171:PHE:CE2	1:A:260:ALA:HB2	2.56	0.41
1:A:27:LEU:HD23	1:A:27:LEU:HA	1.90	0.41

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	262/264 (99%)	255 (97%)	5 (2%)	2 (1%)	19 15

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	94	TYR
1	A	21	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	233/233 (100%)	223 (96%)	10 (4%)	29 29

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	20	ASP
1	A	39	GLN
1	A	67	THR
1	A	78	THR
1	A	130	VAL
1	A	143	LEU
1	A	166	ARG
1	A	222	ARG
1	A	225	ARG
1	A	231	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	9	GLN
1	A	190	GLN

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)

3 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	DDU	A	301	-	16,16,16	1.14	3 (18%)	22,23,23	1.81	4 (18%)
2	PO4	A	300	-	4,4,4	2.54	4 (100%)	6,6,6	2.08	4 (66%)
4	FMT	A	302	1	2,2,2	0.71	0	1,1,1	0.46	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
3	DDU	A	301	-	-	0/4/16/16	0/2/2/2

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	300	PO4	P-O4	-2.84	1.46	1.54
2	A	300	PO4	P-O2	-2.62	1.46	1.54
2	A	300	PO4	P-O3	-2.52	1.47	1.54
3	A	301	DDU	O4'-C1'	2.32	1.47	1.42
3	A	301	DDU	C6-C5	2.20	1.40	1.35
3	A	301	DDU	C6-N1	-2.17	1.32	1.38
2	A	300	PO4	P-O1	2.15	1.55	1.50

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	301	DDU	O4'-C1'-N1	6.60	119.66	107.86
3	A	301	DDU	C2'-C3'-C4'	-2.48	97.60	102.78
2	A	300	PO4	O4-P-O1	-2.38	102.19	110.89
2	A	300	PO4	O4-P-O2	2.31	115.39	107.97
2	A	300	PO4	O4-P-O3	2.23	115.13	107.97
3	A	301	DDU	C1'-N1-C6	-2.23	117.15	121.55
2	A	300	PO4	O3-P-O1	-2.19	102.90	110.89
3	A	301	DDU	C6-N1-C2	2.16	123.75	120.99

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	301	DDU	2	0

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

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.