



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 02:36 PM UTC

PDB ID : 172D / pdb_0000172d
Title : MULTIPLE BINDING MODES OF ANTICANCER DRUG ACTINOMYCIN D: X-RAY, MOLECULAR MODELING, AND SPECTROSCOPIC STUDIES OF D(GAAGCTTC)2-ACTINOMYCIN D COMPLEXES AND ITS HOST DNA
Authors : Kamitori, S.; Takusagawa, F.
Deposited on : 1994-04-18
Resolution : 3.00 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 types of validation reports are described at

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

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

MolProbity : 4-5-2 with Phenix2.0
Xtriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

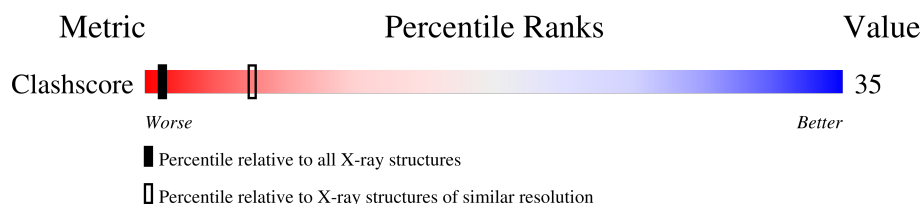
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.00 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	190562	2977 (3.00-3.00)

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 of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	8	 100%
1	B	8	 100%
1	C	8	 100%
1	D	8	 12% 62% 25%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 784 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 DNA chain called DNA (5'-D(*GP*AP*AP*GP*CP*TP*TP*C)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	8	Total	C	N	O	P	0	0	0
			161	78	30	46	7			
1	B	8	Total	C	N	O	P	0	0	0
			161	78	30	46	7			
1	C	8	Total	C	N	O	P	0	0	0
			161	78	30	46	7			
1	D	8	Total	C	N	O	P	0	0	0
			161	78	30	46	7			

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	36	Total	O	0	0
			36	36		
2	B	35	Total	O	0	0
			35	35		
2	C	32	Total	O	0	0
			32	32		
2	D	37	Total	O	0	0
			37	37		

3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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: DNA (5'-D(*GP*AP*AP*GP*CP*TP*TP*C)-3')

Chain A:  100%

G1
A2
A3
C4
C5
T6
T7
C8

- Molecule 1: DNA (5'-D(*GP*AP*AP*GP*CP*TP*TP*C)-3')

Chain B:  100%

G9
A10
A11
G12
C13
T14
T15
C16

- Molecule 1: DNA (5'-D(*GP*AP*AP*GP*CP*TP*TP*C)-3')

Chain C:  100%

G17
A18
A19
G20
C21
T22
T23
C24

- Molecule 1: DNA (5'-D(*GP*AP*AP*GP*CP*TP*TP*C)-3')

Chain D:  12% 62% 25%

G25
A26
A27
G28
C29
T30
T31
C32

4 Data and refinement statistics

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

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, α , β , γ	70.54Å 70.54Å 53.30Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	10.00 – 3.00	Depositor
% Data completeness (in resolution range)	(Not available) (10.00-3.00)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, R_{free}	0.212 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	784	wwPDB-VP
Average B, all atoms (Å ²)	14.0	wwPDB-VP

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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	1.24	2/180 (1.1%)	3.10	26/276 (9.4%)
1	B	1.37	0/180	3.30	35/276 (12.7%)
1	C	1.32	0/180	3.11	32/276 (11.6%)
1	D	1.42	0/180	3.14	27/276 (9.8%)
All	All	1.34	2/720 (0.3%)	3.16	120/1104 (10.9%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	3	DA	O3'-P	5.29	1.69	1.61
1	A	5	DC	O3'-P	5.10	1.68	1.61

All (120) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	24	DC	O4'-C1'-N1	15.13	131.09	108.40
1	D	31	DT	C2'-C3'-O3'	-14.60	89.61	111.50
1	D	27	DA	C2'-C3'-O3'	-13.25	91.63	111.50
1	D	31	DT	O4'-C1'-C2'	-13.21	86.59	106.40
1	B	13	DC	O4'-C1'-N1	12.87	127.70	108.40
1	D	27	DA	C4'-C3'-O3'	12.42	128.63	110.00
1	A	5	DC	O4'-C1'-N1	12.36	126.94	108.40
1	A	8	DC	P-O5'-C5'	12.34	138.51	120.00
1	C	19	DA	C4'-C3'-O3'	11.63	127.44	110.00
1	C	17	DG	C4'-C3'-O3'	11.60	127.39	110.00
1	B	15	DT	C4'-C3'-O3'	10.52	125.78	110.00
1	B	12	DG	C2'-C3'-O3'	10.37	127.06	111.50
1	A	7	DT	C2'-C3'-O3'	-10.24	96.14	111.50
1	B	16	DC	O4'-C1'-N1	10.20	123.70	108.40
1	C	22	DT	O3'-P-O5'	10.09	119.14	104.00
1	A	6	DT	O3'-P-O5'	9.88	118.81	104.00
1	C	20	DG	C2'-C3'-O3'	9.85	126.28	111.50
1	A	5	DC	C4'-C3'-O3'	9.81	124.71	110.00

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	13	DC	P-O3'-C3'	9.79	134.88	120.20
1	A	2	DA	O3'-P-O5'	9.66	118.49	104.00
1	B	12	DG	C4'-C3'-O3'	-9.54	95.69	110.00
1	A	2	DA	P-O3'-C3'	9.17	133.95	120.20
1	A	3	DA	P-O3'-C3'	8.97	133.66	120.20
1	B	13	DC	C4'-C3'-C2'	-8.81	89.18	102.40
1	D	28	DG	P-O5'-C5'	8.70	133.05	120.00
1	D	27	DA	P-O5'-C5'	8.60	132.90	120.00
1	C	19	DA	C5'-C4'-O4'	8.46	122.09	109.40
1	B	15	DT	P-O3'-C3'	8.44	132.86	120.20
1	B	14	DT	C2'-C3'-O3'	8.30	123.96	111.50
1	A	6	DT	C2'-C3'-O3'	8.27	123.90	111.50
1	B	14	DT	P-O3'-C3'	8.24	132.56	120.20
1	A	3	DA	N9-C1'-C2'	-8.13	101.31	113.50
1	D	27	DA	O4'-C1'-N9	8.09	120.54	108.40
1	B	14	DT	C4'-C3'-O3'	8.08	122.12	110.00
1	B	9	DG	C4'-C3'-O3'	8.01	122.02	110.00
1	B	12	DG	C5'-C4'-O4'	7.97	121.36	109.40
1	A	3	DA	O4'-C1'-N9	7.84	120.16	108.40
1	B	15	DT	C2'-C3'-O3'	-7.77	99.84	111.50
1	C	18	DA	O5'-C5'-C4'	7.46	121.99	110.80
1	C	18	DA	C5'-C4'-O4'	-7.45	98.22	109.40
1	C	19	DA	O5'-C5'-C4'	7.44	121.96	110.80
1	A	8	DC	O5'-C5'-C4'	-7.42	99.67	110.80
1	D	32	DC	O4'-C1'-N1	7.33	119.40	108.40
1	C	19	DA	O3'-P-O5'	7.33	114.99	104.00
1	A	7	DT	C4'-C3'-O3'	7.31	120.97	110.00
1	C	22	DT	C5'-C4'-C3'	7.30	125.86	114.90
1	D	27	DA	P-O3'-C3'	7.24	131.06	120.20
1	B	11	DA	P-O5'-C5'	7.13	130.70	120.00
1	A	3	DA	O3'-P-O5'	7.13	114.70	104.00
1	D	31	DT	O3'-P-O5'	-7.10	93.35	104.00
1	A	6	DT	P-O3'-C3'	7.09	130.84	120.20
1	B	15	DT	C4'-C3'-C2'	-6.94	91.99	102.40
1	B	13	DC	N1-C1'-C2'	-6.92	103.11	113.50
1	B	11	DA	C2'-C3'-O3'	6.91	121.86	111.50
1	D	29	DC	C2'-C3'-O3'	6.90	121.85	111.50
1	D	31	DT	C4'-C3'-O3'	6.88	120.32	110.00
1	B	12	DG	N9-C1'-C2'	6.79	123.69	113.50
1	A	4	DG	N9-C1'-C2'	6.72	123.57	113.50
1	B	9	DG	C8-N9-C1'	6.70	137.05	127.00
1	B	15	DT	C5-C4-O4	6.69	132.63	122.60

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	13	DC	O5'-C5'-C4'	-6.65	100.83	110.80
1	C	19	DA	C4'-C3'-C2'	-6.62	92.46	102.40
1	A	1	DG	C4'-C3'-C2'	-6.62	92.47	102.40
1	D	31	DT	O5'-C5'-C4'	6.55	120.62	110.80
1	D	28	DG	P-O3'-C3'	6.55	130.02	120.20
1	D	31	DT	P-O5'-C5'	6.48	129.72	120.00
1	B	10	DA	P-O3'-C3'	6.47	129.91	120.20
1	A	7	DT	C5'-C4'-O4'	-6.44	99.75	109.40
1	D	30	DT	C6-C5-C7	-6.29	114.56	124.00
1	B	12	DG	P-O5'-C5'	6.23	129.34	120.00
1	C	17	DG	C2'-C3'-O3'	6.20	120.79	111.50
1	D	27	DA	C4-N9-C1'	-6.09	117.91	127.05
1	B	9	DG	O5'-C5'-C4'	6.03	119.85	110.80
1	B	11	DA	N9-C1'-C2'	6.01	122.51	113.50
1	C	17	DG	O3'-P-O5'	5.99	112.99	104.00
1	A	7	DT	N1-C1'-C2'	-5.96	104.56	113.50
1	C	19	DA	P-O3'-C3'	-5.95	111.27	120.20
1	C	23	DT	C2'-C3'-O3'	5.93	120.40	111.50
1	C	23	DT	O5'-C5'-C4'	5.91	119.67	110.80
1	A	3	DA	C2'-C3'-O3'	5.90	120.36	111.50
1	D	27	DA	C8-N9-C1'	5.81	135.77	127.05
1	B	10	DA	O5'-C5'-C4'	5.78	119.47	110.80
1	C	21	DC	N1-C1'-C2'	5.77	122.15	113.50
1	A	2	DA	C5'-C4'-C3'	-5.75	106.27	114.90
1	C	23	DT	P-O3'-C3'	5.74	128.80	120.20
1	D	32	DC	C4'-C3'-O3'	5.72	118.58	110.00
1	C	23	DT	C5-C4-O4	5.68	131.12	122.60
1	B	11	DA	O5'-C5'-C4'	-5.66	102.31	110.80
1	B	13	DC	C5'-C4'-C3'	-5.61	106.48	114.90
1	C	23	DT	C4'-C3'-O3'	-5.60	101.59	110.00
1	B	16	DC	C4'-C3'-O3'	5.60	118.40	110.00
1	C	22	DT	C6-C5-C7	-5.60	115.61	124.00
1	C	17	DG	O4'-C4'-C3'	-5.58	97.02	105.40
1	D	28	DG	C2'-C3'-O3'	5.54	119.80	111.50
1	B	15	DT	O5'-C5'-C4'	-5.53	102.50	110.80
1	C	20	DG	C4'-C3'-O3'	5.51	118.27	110.00
1	A	7	DT	C6-C5-C7	-5.49	115.76	124.00
1	D	31	DT	O4'-C1'-N1	5.46	116.58	108.40
1	A	7	DT	O4'-C1'-C2'	-5.45	98.23	106.40
1	B	14	DT	C5-C4-O4	5.43	130.75	122.60
1	A	2	DA	N9-C1'-C2'	5.42	121.63	113.50
1	C	18	DA	C4'-C3'-O3'	5.40	118.09	110.00

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	23	DT	C4'-C3'-C2'	-5.38	94.32	102.40
1	D	27	DA	C4'-C3'-C2'	-5.38	94.32	102.40
1	C	18	DA	O4'-C1'-N9	5.36	116.44	108.40
1	C	21	DC	P-O5'-C5'	5.34	128.01	120.00
1	C	23	DT	O4'-C4'-C3'	5.32	113.38	105.40
1	D	29	DC	C4'-C3'-C2'	-5.31	94.43	102.40
1	B	10	DA	C4'-C3'-C2'	-5.30	94.44	102.40
1	D	31	DT	N1-C1'-C2'	-5.30	105.55	113.50
1	C	24	DC	P-O5'-C5'	-5.26	112.11	120.00
1	A	6	DT	C4-C5-C7	-5.21	114.58	122.40
1	D	28	DG	C4'-C3'-O3'	5.11	117.67	110.00
1	B	15	DT	C1'-O4'-C4'	-5.11	102.04	109.70
1	C	17	DG	P-O3'-C3'	5.10	127.86	120.20
1	D	31	DT	C3'-C2'-C1'	5.10	109.25	101.60
1	A	6	DT	N1-C1'-C2'	5.07	121.11	113.50
1	B	11	DA	C5'-C4'-C3'	-5.07	107.29	114.90
1	C	20	DG	P-O5'-C5'	5.03	127.55	120.00
1	D	26	DA	C1'-O4'-C4'	-5.01	102.18	109.70

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	161	0	92	17	0
1	B	161	0	90	10	0
1	C	161	0	92	13	0
1	D	161	0	92	2	0
2	A	36	0	0	0	0
2	B	35	0	0	0	0
2	C	32	0	0	0	0
2	D	37	0	0	1	0
All	All	784	0	366	35	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 35.

All (35) 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:17:DG:H2''	1:C:18:DA:H5'	1.42	1.01
1:A:7:DT:H1'	1:C:18:DA:H4'	1.45	0.96
1:A:3:DA:H2''	1:A:4:DG:H5'	1.48	0.93
1:A:6:DT:C6	1:A:7:DT:H72	2.22	0.75
1:B:16:DC:H6	1:B:16:DC:H5''	1.50	0.74
1:B:9:DG:HO5'	1:B:9:DG:H8	1.39	0.70
1:A:2:DA:H2'	1:A:3:DA:C8	2.30	0.67
1:D:26:DA:H4'	2:D:168:HOH:O	1.96	0.66
1:C:17:DG:C2'	1:C:18:DA:H5'	2.27	0.59
1:A:1:DG:H2'	1:A:2:DA:C8	2.39	0.58
1:B:16:DC:H5''	1:B:16:DC:C6	2.36	0.58
1:B:14:DT:C6	1:B:15:DT:H72	2.39	0.57
1:A:7:DT:O2	1:C:18:DA:H5''	2.06	0.55
1:A:8:DC:H4'	1:C:18:DA:OP1	2.08	0.54
1:A:3:DA:C2'	1:A:4:DG:H5'	2.32	0.53
1:B:9:DG:H8	1:B:9:DG:O5'	1.92	0.53
1:B:13:DC:H1'	1:D:32:DC:H2'	1.91	0.52
1:C:23:DT:H2'	1:C:24:DC:O4'	2.11	0.51
1:B:14:DT:H3'	1:B:15:DT:H72	1.92	0.51
1:A:7:DT:H4'	1:C:19:DA:H5'	1.93	0.50
1:B:14:DT:H3'	1:B:15:DT:C7	2.42	0.50
1:A:5:DC:H2''	1:A:6:DT:C7	2.42	0.49
1:B:10:DA:H2'	1:B:11:DA:C8	2.48	0.49
1:C:19:DA:H2'	1:C:20:DG:O5'	2.11	0.49
1:A:2:DA:H2'	1:A:3:DA:H8	1.77	0.48
1:A:6:DT:H2'	1:A:7:DT:C6	2.51	0.45
1:C:21:DC:H2'	1:C:22:DT:C6	2.53	0.44
1:B:12:DG:H4'	1:C:17:DG:C6	2.52	0.44
1:C:18:DA:H2''	1:C:19:DA:H5'	2.00	0.44
1:C:19:DA:H2'	1:C:20:DG:C5'	2.48	0.44
1:A:1:DG:C6	1:A:2:DA:C6	3.05	0.43
1:A:2:DA:C6	1:A:3:DA:N6	2.87	0.43
1:A:6:DT:N1	1:A:7:DT:H72	2.34	0.42
1:A:4:DG:H2'	1:A:5:DC:O4'	2.20	0.41
1:A:8:DC:O4'	1:C:18:DA:O5'	2.38	0.41

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

There are no protein molecules in this entry.

5.3.2 Protein sidechains [i](#)

There are no protein molecules in this entry.

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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.