



# Full wwPDB X-ray Structure Validation Report i

Feb 27, 2014 – 12:43 PM GMT

PDB ID : 1D12  
Title : STRUCTURAL COMPARISON OF ANTICANCER DRUG-DNA COMPLEXES. ADRIAMYCIN AND DAUNOMYCIN  
Authors : Frederick, C.A.; Williams, L.D.; Ughetto, G.; Van Der Marel, G.A.; Van Boom, J.H.; Rich, A.; Wang, A.H.-J.  
Deposited on : 1989-10-20  
Resolution : 1.70 Å(reported)

This is a full wwPDB 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 <http://wwpdb.org/ValidationPDFNotes.html>

---

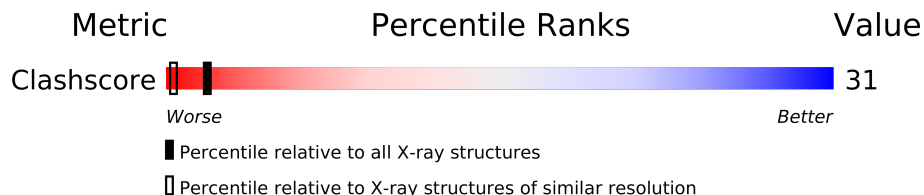
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 21963  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance

The reported resolution of this entry is 1.70 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	79885	2929 (1.70-1.70)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	6	

## 2 Entry composition i

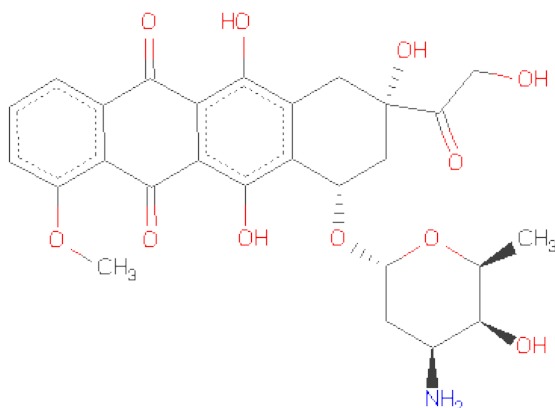
There are 5 unique types of molecules in this entry. The entry contains 230 atoms, of which 0 are hydrogen and 0 are deuterium.

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(\*CP\*GP\*AP\*TP\*CP\*G)-3').

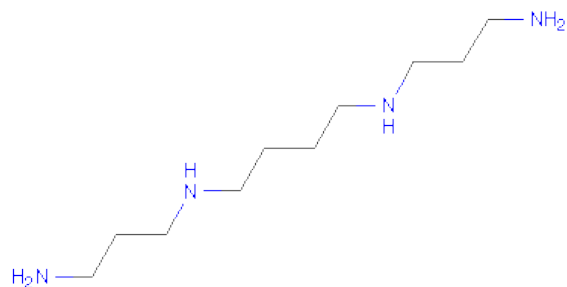
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	A	6	120	58	23	34	5	0	0	0

- Molecule 2 is DOXORUBICIN (three-letter code: DM2) (formula: C<sub>27</sub>H<sub>29</sub>NO<sub>11</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	39	27	1	11	0	0

- Molecule 3 is SPERMINE (three-letter code: SPM) (formula: C<sub>10</sub>H<sub>26</sub>N<sub>4</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	N	0	0
			14	10	4		

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Na	0	0
			1	1		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	56	Total	O	0	0
			56	56		

### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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 ( $\text{RSRZ} > 2$ ). 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.

Note EDS was not executed.

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

Chain A:  

C1	G2	A3	T4	C5	G6
----	----	----	----	----	----

## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	28.21Å 28.21Å 53.19Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 1.70	Depositor
% Data completeness (in resolution range)	(Not available) (10.00-1.70)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	NUCLSQ	Depositor
R, $R_{free}$	0.177 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	230	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	19.0	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: NA, DM2, SPM

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	3.75	23/134 (17.2%)	5.06	49/205 (23.9%)

All (23) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	6	DG	C2-N2	-12.99	1.21	1.34
1	A	5	DC	O4'-C1'	-9.60	1.30	1.42
1	A	2	DG	N9-C8	-9.23	1.31	1.37
1	A	5	DC	P-O5'	8.65	1.68	1.59
1	A	2	DG	C6-N1	-8.63	1.33	1.39
1	A	1	DC	C2'-C1'	8.21	1.60	1.52
1	A	2	DG	C2-N2	-8.15	1.26	1.34
1	A	4	DT	O4'-C1'	7.90	1.51	1.42
1	A	6	DG	C5'-C4'	7.07	1.59	1.51
1	A	2	DG	P-OP2	-6.87	1.37	1.49
1	A	6	DG	C6-N1	-6.85	1.34	1.39
1	A	2	DG	C1'-N9	-6.69	1.37	1.47
1	A	5	DC	C2'-C1'	6.33	1.58	1.52
1	A	5	DC	N3-C4	5.95	1.38	1.33
1	A	6	DG	C2'-C1'	5.75	1.58	1.52
1	A	2	DG	C5'-C4'	5.74	1.57	1.51
1	A	2	DG	P-O5'	5.68	1.65	1.59
1	A	3	DA	C1'-N9	-5.55	1.39	1.47
1	A	1	DC	C3'-O3'	-5.49	1.36	1.44
1	A	1	DC	O3'-P	5.40	1.67	1.61
1	A	3	DA	N9-C8	-5.35	1.33	1.37
1	A	5	DC	C3'-O3'	-5.25	1.37	1.44
1	A	4	DT	P-O5'	5.13	1.64	1.59

All (49) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	5	DC	O4'-C1'-N1	21.95	123.37	108.00
1	A	1	DC	N3-C4-C5	-20.11	113.86	121.90
1	A	1	DC	C2-N3-C4	17.16	128.48	119.90
1	A	2	DG	N1-C2-N3	12.65	131.49	123.90
1	A	4	DT	C4-C5-C7	12.35	126.41	119.00
1	A	6	DG	N3-C2-N2	-12.29	111.30	119.90
1	A	4	DT	C6-C5-C7	-12.26	115.55	122.90
1	A	2	DG	C6-N1-C2	-12.11	117.83	125.10
1	A	2	DG	C5-C6-N1	11.32	117.16	111.50
1	A	2	DG	N3-C2-N2	-11.13	112.11	119.90
1	A	6	DG	C6-N1-C2	-11.09	118.45	125.10
1	A	6	DG	C5-C6-N1	11.06	117.03	111.50
1	A	4	DT	O4'-C1'-N1	-10.56	100.61	108.00
1	A	5	DC	N3-C4-C5	-10.54	117.69	121.90
1	A	3	DA	O5'-P-OP1	-10.32	96.41	105.70
1	A	2	DG	P-O3'-C3'	9.78	131.43	119.70
1	A	2	DG	O4'-C1'-N9	9.40	114.58	108.00
1	A	2	DG	OP1-P-OP2	8.81	132.82	119.60
1	A	5	DC	C5-C6-N1	8.56	125.28	121.00
1	A	5	DC	C2-N3-C4	8.47	124.14	119.90
1	A	2	DG	N1-C6-O6	-8.40	114.86	119.90
1	A	6	DG	O4'-C1'-N9	-8.40	102.12	108.00
1	A	6	DG	N1-C2-N3	7.68	128.50	123.90
1	A	6	DG	O5'-P-OP1	-7.34	99.10	105.70
1	A	1	DC	C5-C4-N4	7.17	125.22	120.20
1	A	5	DC	C2-N1-C1'	-7.07	111.03	118.80
1	A	6	DG	N1-C6-O6	-7.00	115.70	119.90
1	A	1	DC	N1-C2-O2	6.97	123.08	118.90
1	A	2	DG	O3'-P-O5'	6.92	117.15	104.00
1	A	1	DC	C1'-O4'-C4'	6.92	117.02	110.10
1	A	5	DC	C6-N1-C1'	6.69	128.83	120.80
1	A	1	DC	C5-C6-N1	6.61	124.31	121.00
1	A	2	DG	C2-N3-C4	-6.61	108.60	111.90
1	A	5	DC	P-O5'-C5'	-6.41	110.64	120.90
1	A	1	DC	N1-C2-N3	-6.21	114.85	119.20
1	A	5	DC	N1-C2-O2	6.07	122.54	118.90
1	A	1	DC	O4'-C1'-N1	5.92	112.14	108.00
1	A	1	DC	C6-N1-C1'	5.78	127.74	120.80
1	A	4	DT	N3-C4-O4	-5.75	116.45	119.90
1	A	6	DG	O4'-C1'-C2'	-5.75	101.30	105.90
1	A	4	DT	O5'-P-OP1	-5.59	100.67	105.70
1	A	4	DT	N1-C2-O2	-5.52	118.69	123.10
1	A	1	DC	O4'-C4'-C3'	-5.49	102.31	104.50

Continued on next page...



*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1	DC	C2-N1-C1'	-5.34	112.92	118.80
1	A	2	DG	C4'-C3'-O3'	-5.31	96.42	109.70
1	A	3	DA	C4'-C3'-C2'	5.25	107.83	103.10
1	A	5	DC	N3-C4-N4	5.13	121.59	118.00
1	A	1	DC	C4'-C3'-C2'	5.10	107.69	103.10
1	A	3	DA	C5'-C4'-C3'	5.08	123.25	114.10

There are no chirality outliers.

There are no planarity outliers.

## 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	120	0	65	4	0
2	A	39	0	29	0	0
3	A	14	0	26	9	0
4	A	1	0	0	0	0
5	A	56	0	0	3	1
All	All	230	0	120	9	1

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 31.

All (9) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
3:A:8:SPM:H71	3:A:8:SPM:H111	1.51	0.92
3:A:8:SPM:H61	5:A:32:HOH:O	1.70	0.92
3:A:8:SPM:H72	5:A:48:HOH:O	1.76	0.86
3:A:8:SPM:H122	5:A:32:HOH:O	1.88	0.72
1:A:4:DT:H73	3:A:8:SPM:H32	1.80	0.63
1:A:5:DC:H5	3:A:8:SPM:N1	2.05	0.55
1:A:4:DT:C7	3:A:8:SPM:H32	2.36	0.54
1:A:4:DT:H71	3:A:8:SPM:H81	2.03	0.41
3:A:8:SPM:H71	3:A:8:SPM:C11	2.37	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
5:A:45:HOH:O	5:A:46:HOH:O[2_664]	2.11	0.09

## 5.3 Torsion angles

### 5.3.1 Protein backbone ⓘ

There are no protein chains in this entry.

### 5.3.2 Protein sidechains ⓘ

There are no protein chains in this entry.

### 5.3.3 RNA ⓘ

There are no RNA chains 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 ⓘ

Of 3 ligands modelled in this entry, 1 is 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
2	DM2	A	7	-	43,43,43	3.05	14 (32%)	67,67,67	2.87	22 (32%)
3	SPM	A	8	-	13,13,13	1.91	3 (23%)	12,12,12	1.78	1 (8%)

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
2	DM2	A	7	-	-	0/14/60/60	0/1/5/5
3	SPM	A	8	-	-	0/11/11/11	0/0/0/0

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	7	DM2	O13-C13	11.79	1.42	1.21
2	A	7	DM2	O6-C6	8.06	1.38	1.22
2	A	7	DM2	O19-C19	6.79	1.36	1.22
2	A	7	DM2	C20-C19	-4.93	1.37	1.48
3	A	8	SPM	C4-N5	4.48	1.61	1.46
2	A	7	DM2	C15-C16	-3.90	1.45	1.51
2	A	7	DM2	O12-C12	3.61	1.51	1.43
2	A	7	DM2	C7-C6	-3.55	1.38	1.47
2	A	7	DM2	C18-C19	-3.44	1.38	1.47
2	A	7	DM2	C5-C6	-3.39	1.38	1.47
3	A	8	SPM	C11-N10	3.22	1.57	1.46
2	A	7	DM2	O10-C10	-3.16	1.38	1.44
2	A	7	DM2	C15-C12	2.59	1.57	1.53
3	A	8	SPM	C6-N5	2.36	1.54	1.46
2	A	7	DM2	C4'-C5'	2.26	1.57	1.52
2	A	7	DM2	O17-C17	2.18	1.42	1.37
2	A	7	DM2	C9-C10	-2.05	1.47	1.51

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	7	DM2	C1'-O10-C10	14.91	136.77	115.84
2	A	7	DM2	O12-C12-C11	9.11	127.65	109.13
3	A	8	SPM	C3-C4-N5	-4.91	99.04	112.09
2	A	7	DM2	O14-C14-C13	4.53	122.54	112.52
2	A	7	DM2	O5'-C1'-C2'	4.21	117.30	110.82
2	A	7	DM2	C14-C13-C12	3.79	121.91	117.72

Continued on next page...

*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	7	DM2	C21-O4-C4	3.56	122.85	117.59
2	A	7	DM2	C1'-O5'-C5'	-3.40	105.82	114.20
2	A	7	DM2	O4'-C4'-C3'	-3.32	101.87	109.66
2	A	7	DM2	O13-C13-C12	-3.26	116.64	122.11
2	A	7	DM2	C4'-C3'-N3'	3.20	117.02	110.83
2	A	7	DM2	O5'-C5'-C4'	3.07	114.72	109.53
2	A	7	DM2	C11-C10-C9	3.01	118.26	111.16
2	A	7	DM2	C5'-C4'-C3'	3.00	116.35	110.81
2	A	7	DM2	O4-C4-C5	2.88	120.33	115.82
2	A	7	DM2	C7-C6-C5	2.61	122.68	118.01
2	A	7	DM2	O4-C4-C3	-2.58	120.11	124.37
2	A	7	DM2	O6-C6-C7	-2.57	116.84	121.50
2	A	7	DM2	C15-C16-C17	2.39	123.68	119.04
2	A	7	DM2	C3-C2-C1	-2.26	116.76	120.25
2	A	7	DM2	C11-C12-C15	-2.24	105.97	110.31
2	A	7	DM2	O4'-C4'-C5'	-2.23	104.61	109.78
2	A	7	DM2	O12-C12-C13	-2.20	103.59	108.44

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 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 will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

### 6.3 Carbohydrates ⓘ

EDS was not executed - this section will therefore be empty.

### 6.4 Ligands ⓘ

EDS was not executed - this section will therefore be empty.

### 6.5 Other polymers ⓘ

EDS was not executed - this section will therefore be empty.