wwPDB X-ray Structure Validation Summary Report ⓘ

Nov 6, 2023 – 11:40 AM EST

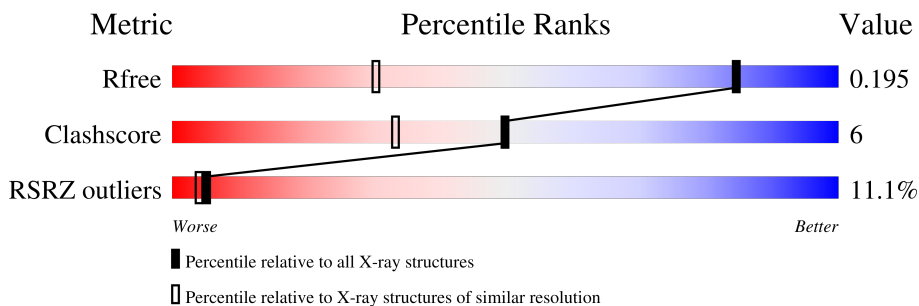|		
PDB ID	:	7KZL
Title	:	Cyclopentane peptide nucleic acid in complex with DNA
Authors	:	Botos, I.; Appella, D.H.
Deposited on	:	2020-12-10
Resolution	:	1.30 Å(reported)

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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 1.30 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	Percentile Ranks	Value
Rfree		0.195
Clashscore		6
RSRZ outliers		11.1%

Worse   *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1058 (1.30-1.30)
Clashscore	141614	1101 (1.30-1.30)
RSRZ outliers	127900	1029 (1.30-1.30)

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% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	9	11% / 78% 11% 11%
2	B	10	10% 50% 40%

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
3	IOD	A	101	-	-	X	-
5	MOH	B	102	-	X	-	-

2 Entry composition ⓘ

There are 7 unique types of molecules in this entry. The entry contains 675 atoms, of which 167 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(*TP*AP*TP*CP*AP*CP*AP*TP*C)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	9	Total	C	N	O	P	0	0	0
			176	86	30	52	8			

- Molecule 2 is a protein called XDJ-XDD-XDY-XDJ-XDY-XDJ-XDD-XDY-XDD-XDV.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	10	Total	C	H	N	O	0	0	0
			385	132	167	56	30			

- Molecule 3 is IODIDE ION (three-letter code: IOD) (formula: I).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	I	0	0
			1	1		

- Molecule 4 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	2	Total	Zn	0	0
			2	2		
4	B	4	Total	Zn	0	0
			4	4		

- Molecule 5 is METHANOL (three-letter code: MOH) (formula: CH_4O).

MOH

C —— **OH** O
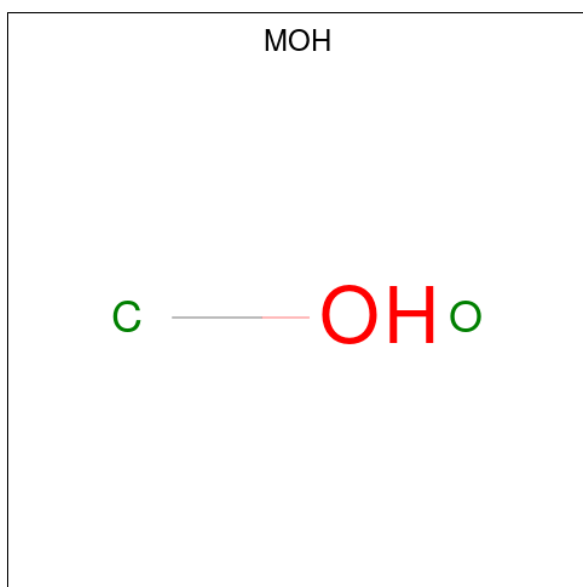
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	B	1	Total 2	C 1	O 1	0	0
5	B	1	Total 2	C 1	O 1	0	0
5	B	1	Total 2	C 1	O 1	0	0

- Molecule 6 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: $C_2H_6O_2$).

EDO

O2

OH

C1

C2

HO

O1

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	B	1	Total 4	C 2	O 2	0	0

• Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	47	Total O 47 47		0	0
7	B	50	Total O 50 50		0	0

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 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 (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.

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

Chain A:
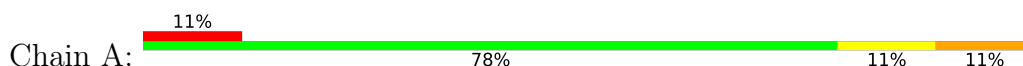
• Molecule 2: XDJ-XDD-XDY-XDJ-XDY-XDJ-XDD-XDY-XDD-XDV

Chain B:
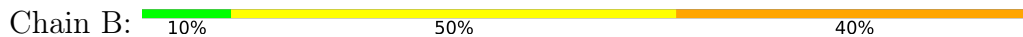
4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α, β, γ	54.70Å 54.70Å 39.63Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	32.09 – 1.30 32.09 – 1.30	Depositor EDS
% Data completeness (in resolution range)	99.7 (32.09-1.30) 98.5 (32.09-1.30)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	9.51 (at 1.30Å)	Xtriage
Refinement program	PHENIX 1.13_2998	Depositor
R, R_{free}	0.172 , 0.189 0.177 , 0.195	Depositor DCC
R_{free} test set	777 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å^2)	13.5	Xtriage
Anisotropy	0.035	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.41 , 47.4	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	675	wwPDB-VP
Average B, all atoms (Å^2)	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.66% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5   Model quality ⓘ

5.1   Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: XDD, ZN, XDV, IOD, XDY, MOH, EDO, XDJ

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	1.51	2/196 (1.0%)	1.41	4/299 (1.3%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
2	B	0	5

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1	DT	N1-C6	-9.64	1.31	1.38
1	A	1	DT	C5-C6	-5.96	1.30	1.34

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1	DT	C4-C5-C6	10.21	124.13	118.00
1	A	1	DT	N3-C4-O4	7.84	124.60	119.90
1	A	1	DT	N3-C4-C5	-5.65	111.81	115.20
1	A	3	DT	C1'-O4'-C4'	-5.08	105.02	110.10

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	3	XDY	Mainchain

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Mol	Chain	Res	Type	Group
2	B	4	XDJ	Mainchain
2	B	6	XDJ	Peptide,Mainchain
2	B	8	XDY	Mainchain

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	176	0	101	2	0
2	B	218	167	0	0	0
3	A	1	0	0	2	0
4	A	2	0	0	0	0
4	B	4	0	0	0	0
5	B	6	0	0	1	0
6	B	4	0	5	1	0
7	A	47	0	0	0	0
7	B	50	0	0	0	0
All	All	508	167	106	3	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 (3) 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:1:DT:C5	3:A:101:IOD:I	2.47	1.38
1:A:1:DT:C4	3:A:101:IOD:I	3.22	0.60
5:B:103:MOH:C	6:B:104:EDO:H22	2.33	0.58

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

There are no protein backbone outliers to report in this entry.

5.3.2　Protein sidechains　ⓘ

There are no protein residues with a non-rotameric sidechain to report in this entry.

5.3.3　RNA　ⓘ

There are no RNA molecules in this entry.

5.4　Non-standard residues in protein, DNA, RNA chains　ⓘ

9 non-standard protein/DNA/RNA residues 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	$\#|Z| > 2$
2	XDJ	B	1	2,4	22,26,27	2.73	10 (45%)	19,37,39	1.48	5 (26%)
2	XDD	B	9	2	22,25,26	3.13	7 (31%)	17,35,37	1.67	2 (11%)
2	XDY	B	8	2	23,23,24	1.86	5 (21%)	25,32,34	1.84	8 (32%)
2	XDJ	B	4	2	22,26,27	2.65	8 (36%)	19,37,39	1.64	5 (26%)
2	XDD	B	2	2	22,25,26	2.74	6 (27%)	17,35,37	1.53	3 (17%)
2	XDJ	B	6	2,4	22,26,27	2.44	10 (45%)	19,37,39	1.93	6 (31%)
2	XDY	B	5	2	23,23,24	1.63	5 (21%)	25,32,34	1.39	3 (12%)
2	XDD	B	7	2	22,25,26	2.63	5 (22%)	17,35,37	1.70	5 (29%)
2	XDY	B	3	2	23,23,24	1.77	7 (30%)	25,32,34	1.76	6 (24%)

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	XDJ	B	1	2,4	-	0/14/25/26	0/3/3/3
2	XDD	B	9	2	-	0/14/25/26	0/3/3/3
2	XDY	B	8	2	-	0/14/25/26	0/2/2/2
2	XDJ	B	4	2	-	0/14/25/26	0/3/3/3

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W O R L D W I D E
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PROTEIN DATA BANK

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	XDD	B	2	2	-	0/14/25/26	0/3/3/3
2	XDJ	B	6	2,4	-	0/14/25/26	0/3/3/3
2	XDY	B	5	2	-	0/14/25/26	0/2/2/2
2	XDD	B	7	2	-	0/14/25/26	0/3/3/3
2	XDY	B	3	2	-	2/14/25/26	0/2/2/2

The worst 5 of 63 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	9	XDD	C10-C05	8.82	1.68	1.53
2	B	7	XDD	C10-C05	8.00	1.67	1.53
2	B	2	XDD	C10-C05	7.73	1.67	1.53
2	B	9	XDD	C08-CA	7.06	1.66	1.53
2	B	9	XDD	C05-CA	-6.78	1.33	1.52

The worst 5 of 43 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	3	XDY	C-C03-N04	5.70	122.33	112.65
2	B	8	XDY	C-C03-N04	4.43	120.19	112.65
2	B	6	XDJ	C09-C10-C05	-4.39	96.78	104.16
2	B	9	XDD	N22-C21-N20	-4.33	121.92	128.68
2	B	4	XDJ	O-C-C03	-3.96	114.43	126.39

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	3	XDY	C-C03-N04-C05
2	B	3	XDY	C-C03-N04-C11

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 11 ligands modelled in this entry, 7 are monoatomic - leaving 4 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	MOH	B	102	4	1,1,1	2.32	1 (100%)	-		
5	MOH	B	103	4	1,1,1	0.70	0	-		
5	MOH	B	101	4	1,1,1	0.13	0	-		
6	EDO	B	104	4	3,3,3	0.54	0	2,2,2	0.69	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
6	EDO	B	104	4	-	0/1/1/1	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	102	MOH	O-C	-2.32	1.19	1.41

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	103	MOH	1	0
6	B	104	EDO	1	0

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 ⓘ

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å²)	Q<0.9
1	A	9/9 (100%)	0.22	1 (11%)	5	4	12, 14, 23, 24	0
2	B	0/10	-		-		-	-
All	All	9/19 (47%)	0.22	1 (11%)	5	4	12, 14, 23, 24	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1	DT	2.1

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

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å²)	Q<0.9
2	XDY	B	8	22/23	0.94	0.08	11,15,20,20	0
2	XDY	B	3	22/23	0.95	0.08	11,14,21,23	0
2	XDD	B	2	23/24	0.95	0.07	11,14,18,20	0
2	XDD	B	9	23/24	0.95	0.07	11,16,25,27	0
2	XDJ	B	1	24/25	0.96	0.06	11,15,18,20	0
2	XDJ	B	4	24/25	0.96	0.08	9,14,21,24	0
2	XDD	B	7	23/24	0.97	0.07	9,12,15,16	0
2	XDY	B	5	22/23	0.97	0.07	10,12,20,22	0
2	XDJ	B	6	24/25	0.97	0.08	9,11,15,15	0

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands (i)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
5	MOH	B	101	2/2	0.63	0.27	32,32,32,40	0
6	EDO	B	104	4/4	0.73	0.21	24,31,36,42	0
4	ZN	A	103	1/1	0.79	0.10	53,53,53,53	1
4	ZN	B	107	1/1	0.93	0.06	24,24,24,24	1
5	MOH	B	102	2/2	0.97	0.10	13,13,13,18	0
3	IOD	A	101	1/1	0.98	0.04	21,21,21,21	1
4	ZN	B	106	1/1	0.99	0.03	17,17,17,17	1
4	ZN	A	102	1/1	0.99	0.06	16,16,16,16	1
5	MOH	B	103	2/2	0.99	0.10	12,12,12,22	0
4	ZN	B	108	1/1	0.99	0.04	16,16,16,16	1
4	ZN	B	105	1/1	1.00	0.04	12,12,12,12	0

6.5 Other polymers (i)

There are no such residues in this entry.