Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 03:35 AM UTC

PDB ID	:	2DNJ / pdb_00002dnj
Title	:	DNASE I-INDUCED DNA CONFORMATION. 2 ANGSTROMS STRUCTURE OF A DNASE I-OCTAMER COMPLEX
Authors	:	Lahm, A.; Suck, D.
Deposited on	:	1986-10-21
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 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:

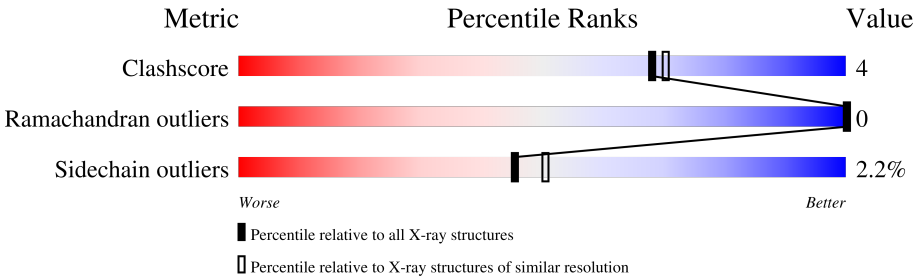
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (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 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	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (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 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	B	8	25% 38% 38%
2	C	6	33% 67%
3	A	260	80% 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
4	NAG	A	1000	X	-	-	-

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 2553 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 5'-D(*GP*CP*GP*AP*TP*CP*GP*C)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	B	8	161	77	31	46	7	0	0	0

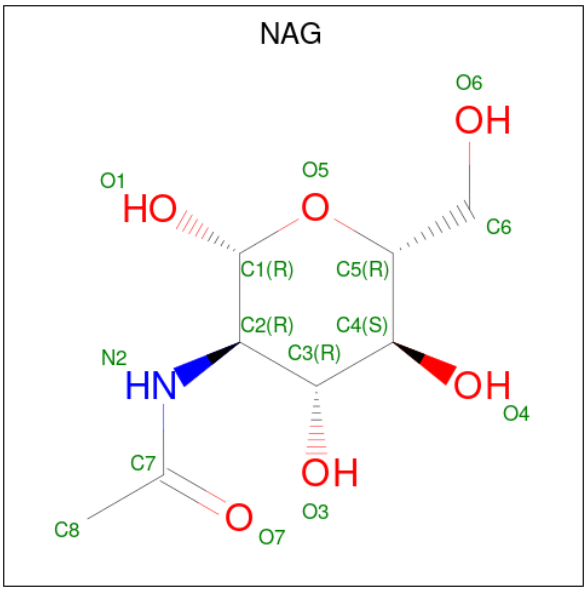
- Molecule 2 is a DNA chain called 5'-D(*GP*CP*GP*AP*TP*C)-3'.

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

- Molecule 3 is a protein called DEOXYRIBONUCLEASE I.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	A	253	2006	1276	333	391	6	0	0	0

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C N O 14 8 1 5	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	24	Total O 24 24	0	0
5	C	13	Total O 13 13	0	0
5	A	215	Total O 215 215	0	0

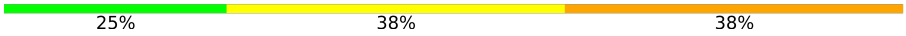
3 Residue-property plots (i)

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.

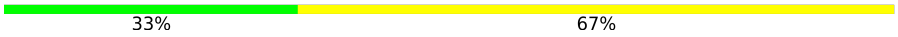
• Molecule 1: 5'-D(*GP*CP*GP*AP*TP*CP*GP*C)-3'

Chain B:



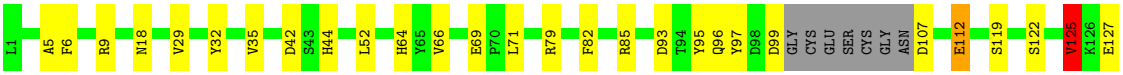
• Molecule 2: 5'-D(*GP*CP*GP*AP*TP*C)-3'

Chain C:



• Molecule 3: DEOXYRIBONUCLEASE I

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	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	72.90Å 100.10Å 92.60Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	6.00 – 2.00	Depositor
% Data completeness (in resolution range)	90.2 (6.00-2.00)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	PROLSQ	Depositor
R, R_{free}	0.174 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2553	wwPDB-VP
Average B, all atoms (Å^2)	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: NAG

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	B	1.25	0/180	2.06	8/276 (2.9%)
2	C	1.45	2/134 (1.5%)	2.50	11/205 (5.4%)
3	A	1.22	4/2051 (0.2%)	1.76	34/2793 (1.2%)
All	All	1.24	6/2365 (0.3%)	1.85	53/3274 (1.6%)

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	260	THR	C-OXT	9.89	1.43	1.23
2	C	310	DC	O3'-P	-5.58	1.52	1.61
3	A	260	THR	CB-OG1	5.55	1.52	1.43
3	A	166	MET	N-CA	5.39	1.52	1.45
2	C	312	DA	P-O5'	5.28	1.71	1.60
3	A	125	VAL	CA-C	5.18	1.58	1.52

All (53) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	310	DC	P-O3'-C3'	11.91	138.07	120.20
2	C	310	DC	C4'-C3'-O3'	10.82	126.24	110.00
2	C	311	DG	P-O3'-C3'	9.53	134.49	120.20
3	A	18	ASN	OD1-CG-ND2	9.14	131.74	122.60
3	A	44	HIS	CA-CB-CG	-8.32	105.48	113.80
3	A	196	ILE	O-C-N	8.11	127.79	121.46
3	A	6	PHE	CA-CB-CG	8.08	121.88	113.80
3	A	166	MET	N-CA-CB	-7.80	98.64	111.66
3	A	107	ASP	CA-C-N	7.68	131.99	120.31
3	A	107	ASP	C-N-CA	7.68	131.99	120.31
1	B	308	DC	C3'-C2'-C1'	-7.47	90.39	101.60
3	A	169	PHE	CA-CB-CG	6.96	120.77	113.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	311	DG	C2'-C3'-O3'	6.63	121.45	111.50
3	A	82	PHE	CA-CB-CG	6.59	120.39	113.80
3	A	32	TYR	N-CA-C	6.52	120.25	110.14
3	A	127	GLU	CA-CB-CG	6.50	127.10	114.10
2	C	311	DG	O5'-C5'-C4'	-6.50	101.06	110.80
3	A	125	VAL	N-CA-CB	6.45	117.56	110.53
1	B	301	DG	C3'-C2'-C1'	-6.41	91.99	101.60
1	B	308	DC	C6-N1-C1'	6.40	129.30	119.70
3	A	79	ARG	NE-CZ-NH2	-6.14	113.68	119.20
1	B	305	DT	P-O3'-C3'	6.04	129.27	120.20
2	C	311	DG	P-O5'-C5'	-5.96	111.06	120.00
3	A	187	ARG	CD-NE-CZ	5.95	132.72	124.40
1	B	307	DG	C8-N9-C1'	5.84	135.76	127.00
2	C	309	DG	C8-N9-C1'	5.81	135.72	127.00
3	A	134	HIS	N-CA-CB	5.73	121.22	110.56
3	A	165	LEU	CB-CA-C	5.72	119.62	109.72
3	A	231	ALA	N-CA-CB	-5.68	105.93	111.27
3	A	119	SER	CA-C-O	-5.66	114.21	120.38
1	B	308	DC	C2-N1-C1'	-5.59	111.32	119.70
3	A	112	GLU	CB-CG-CD	5.58	122.09	112.60
3	A	187	ARG	CG-CD-NE	5.57	124.25	112.00
3	A	137	PRO	CA-C-N	5.48	129.36	120.60
3	A	137	PRO	C-N-CA	5.48	129.36	120.60
3	A	64	HIS	N-CA-CB	5.42	119.06	110.87
2	C	310	DC	C6-N1-C1'	5.38	127.76	119.70
3	A	42	ASP	N-CA-CB	-5.33	102.83	112.27
3	A	210	ALA	CA-C-N	5.33	127.68	120.44
3	A	210	ALA	C-N-CA	5.33	127.68	120.44
2	C	310	DC	O3'-P-O5'	-5.32	96.02	104.00
1	B	305	DT	O5'-C5'-C4'	-5.31	102.83	110.80
3	A	112	GLU	O-C-N	5.24	125.68	121.38
2	C	312	DA	P-O3'-C3'	5.23	128.04	120.20
3	A	99	ASP	CA-C-O	-5.22	111.92	120.80
1	B	302	DC	O3'-P-O5'	-5.21	96.18	104.00
2	C	309	DG	O3'-P-O5'	-5.18	96.24	104.00
3	A	85	ARG	NE-CZ-NH2	5.11	123.80	119.20
3	A	93	ASP	CA-CB-CG	5.09	117.69	112.60
3	A	66	VAL	N-CA-C	-5.06	100.84	108.12
3	A	125	VAL	O-C-N	5.04	128.40	122.81
3	A	122	SER	N-CA-C	5.02	119.13	113.15
3	A	96	GLN	OE1-CD-NE2	5.02	127.62	122.60

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	B	161	0	91	6	0
2	C	120	0	69	0	0
3	A	2006	0	1949	10	0
4	A	14	0	11	0	0
5	A	215	0	0	1	0
5	B	24	0	0	1	0
5	C	13	0	0	1	0
All	All	2553	0	2120	16	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 (16) 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:B:301:DG:H8	1:B:301:DG:O5'	1.54	0.88
1:B:301:DG:H8	1:B:301:DG:HO5'	0.84	0.82
1:B:301:DG:O5'	1:B:301:DG:C8	2.34	0.78
3:A:5:ALA:HB2	3:A:166:MET:HG2	1.75	0.68
3:A:125:VAL:HG13	3:A:220:LEU:HB3	1.80	0.64
1:B:301:DG:N3	5:B:559:HOH:O	2.33	0.55
3:A:125:VAL:HG22	3:A:224:SER:OG	2.05	0.55
1:B:304:DA:H2'	1:B:305:DT:C6	2.43	0.54
3:A:29:VAL:HG13	3:A:35:VAL:HG11	1.99	0.45
3:A:95:TYR:CE2	3:A:157:LYS:HD3	2.52	0.45
3:A:156:GLN:HG3	5:A:406:HOH:O	2.17	0.45
5:C:468:HOH:O	3:A:138:SER:HB2	2.18	0.42
3:A:230:ALA:HA	3:A:256:GLU:O	2.19	0.42
3:A:69:GLU:O	3:A:71:LEU:HG	2.20	0.42
3:A:97:TYR:O	3:A:112:GLU:HB3	2.19	0.42
1:B:308:DC:C6	1:B:308:DC:H3'	2.56	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
3	A	249/260 (96%)	242 (97%)	7 (3%)	0	100 100

There are no Ramachandran outliers to report.

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
3	A	224/229 (98%)	219 (98%)	5 (2%)	45 50

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	A	9	ARG
3	A	52	LEU
3	A	125	VAL
3	A	138	SER
3	A	260	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
3	A	155	GLN
3	A	161	ASN
3	A	236	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 oligosaccharides in this entry.

5.6 Ligand geometry (i)

1 ligand is 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	$\#\|Z\| > 2$
4	NAG	A	1000	3	14,14,15	1.72	3 (21%)	17,19,21	5.06	12 (70%)

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	NAG	A	1000	3	1/1/5/7	4/6/23/26	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	1000	NAG	O5-C1	4.13	1.50	1.43
4	A	1000	NAG	C4-C5	-2.29	1.48	1.53
4	A	1000	NAG	C3-C2	2.27	1.57	1.52

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	A	1000	NAG	O7-C7-C8	-13.02	98.87	122.05
4	A	1000	NAG	C2-N2-C7	8.76	134.63	122.90
4	A	1000	NAG	O3-C3-C4	-5.67	97.01	110.38
4	A	1000	NAG	O5-C1-C2	-5.62	102.60	111.29
4	A	1000	NAG	O4-C4-C3	4.83	121.75	110.38
4	A	1000	NAG	C4-C3-C2	4.38	117.44	111.02
4	A	1000	NAG	C6-C5-C4	4.31	123.61	113.02
4	A	1000	NAG	C3-C4-C5	4.25	117.93	110.23
4	A	1000	NAG	C8-C7-N2	3.60	122.08	116.12
4	A	1000	NAG	C1-C2-N2	-3.29	105.26	110.43
4	A	1000	NAG	O5-C5-C6	2.97	113.45	107.66
4	A	1000	NAG	O4-C4-C5	2.61	115.75	109.32

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	A	1000	NAG	C4

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	1000	NAG	C3-C2-N2-C7
4	A	1000	NAG	C8-C7-N2-C2
4	A	1000	NAG	O7-C7-N2-C2
4	A	1000	NAG	C4-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

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.