



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 08:14 PM UTC

PDB ID : 1AKH / pdb_00001akh
Title : MAT A1/ALPHA2/DNA TERNARY COMPLEX
Authors : Li, T.; Jin, Y.; Vershon, A.K.; Wolberger, C.
Deposited on : 1997-05-19
Resolution : 2.50 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

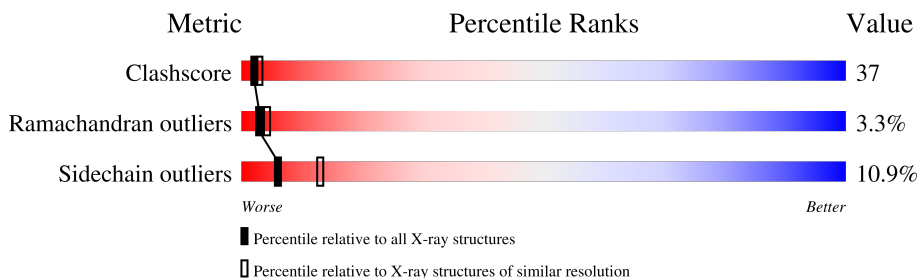
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)

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	C	21	33% 67%
2	D	21	38% 57% 5%
3	A	61	39% 34% 5% • 20%
4	B	83	39% 42% 11% • 6%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 1905 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(*TP*AP*CP*AP*TP*GP*TP*AP*AP*AP*AP*AP*TP*TP*TP*AP*C P*AP*TP*CP*A)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	21	Total	C	N	O	P	0	0	0
			426	207	78	121	20			

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	21	Total	C	N	O	P	0	0	0
			429	209	73	127	20			

- Molecule 3 is a protein called PROTEIN (MATING-TYPE PROTEIN A-1).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	A	49	Total	C	N	O	S	0	0	0
			394	252	76	64	2			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	87	GLU	GLN	conflict	UNP P01366

- Molecule 4 is a protein called PROTEIN (MATING-TYPE PROTEIN ALPHA-2).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	B	78	Total	C	N	O	S	0	0	0
			605	384	115	105	1			

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	C	16	Total 16	O 16	0	0
5	D	15	Total 15	O 15	0	0
5	A	6	Total 6	O 6	0	0
5	B	14	Total 14	O 14	0	0

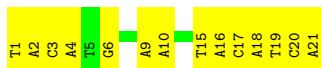
3 Residue-property plots

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. 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.

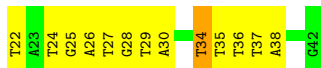
- Molecule 1: DNA (5'-D(*TP*AP*CP*AP*TP*GP*TP*AP*AP*AP*AP*AP*TP*TP*TP*AP*C P*AP*TP*CP*A)-3')

Chain C: 



- Molecule 2: DNA (5'-D(*TP*AP*TP*GP*AP*TP*GP*TP*AP*AP*AP*TP*TP*TP*TP*A P*CP*AP*TP*G)-3')

Chain D: 



- Molecule 3: PROTEIN (MATING-TYPE PROTEIN A-1)

Chain A: 



- Molecule 4: PROTEIN (MATING-TYPE PROTEIN ALPHA-2)

Chain B: 



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 61	Depositor
Cell constants a, b, c, α , β , γ	132.25Å 132.25Å 45.25Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	6.00 – 2.50	Depositor
% Data completeness (in resolution range)	(Not available) (6.00-2.50)	Depositor
R_{merge}	0.05	Depositor
R_{sym}	7.40	Depositor
Refinement program	X-PLOR 3.0	Depositor
R, R_{free}	0.201 , 0.302	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	1905	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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	C	0.60	0/478	1.17	2/735 (0.3%)
2	D	0.67	0/480	1.18	1/740 (0.1%)
3	A	0.93	0/400	1.30	2/534 (0.4%)
4	B	0.89	0/617	1.37	13/837 (1.6%)
All	All	0.79	0/1975	1.26	18/2846 (0.6%)

There are no bond length outliers.

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	146	SER	N-CA-C	-7.38	103.17	111.14
4	B	203	GLU	CA-C-N	6.52	127.99	119.84
4	B	203	GLU	C-N-CA	6.52	127.99	119.84
4	B	198	ASP	N-CA-C	6.34	117.88	110.97
1	C	21	DA	C4'-C3'-O3'	-6.29	100.56	110.00
4	B	187	GLU	N-CA-C	6.21	118.84	111.33
4	B	154	ASN	CA-C-N	5.89	127.20	119.84
4	B	154	ASN	C-N-CA	5.89	127.20	119.84
1	C	6	DG	C5'-C4'-O4'	-5.67	100.90	109.40
4	B	129	LYS	CA-C-N	5.56	125.50	119.78
4	B	129	LYS	C-N-CA	5.56	125.50	119.78
4	B	135	ARG	N-CA-C	5.43	117.74	110.35
4	B	150	LYS	N-CA-C	-5.25	104.98	111.33
4	B	151	ASN	N-CA-C	5.10	119.19	112.92
4	B	182	ASN	N-CA-C	-5.10	105.72	111.28
3	A	95	LEU	N-CA-C	5.09	117.70	108.69
2	D	34	DT	C5'-C4'-O4'	-5.05	101.82	109.40
3	A	105	LYS	N-CA-C	5.04	117.16	111.11

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	C	426	0	240	36	0
2	D	429	0	243	20	0
3	A	394	0	411	35	0
4	B	605	0	592	54	0
5	A	6	0	0	0	0
5	B	14	0	0	2	0
5	C	16	0	0	5	0
5	D	15	0	0	1	0
All	All	1905	0	1486	121	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 37.

All (121) 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:10:DA:H4'	5:C:650:HOH:O	1.30	1.24
1:C:17:DC:H5'	3:A:123:MET:HE1	1.27	1.15
1:C:16:DA:H2''	1:C:17:DC:H5''	1.19	1.09
1:C:18:DA:H2''	1:C:19:DT:C5'	1.93	0.98
1:C:17:DC:C5'	3:A:123:MET:HE1	1.98	0.94
2:D:34:DT:H2''	2:D:35:DT:H5'	1.52	0.90
1:C:1:DT:HO5'	1:C:1:DT:H6	0.93	0.89
1:C:16:DA:C2'	1:C:17:DC:H5''	2.02	0.88
1:C:18:DA:H2''	1:C:19:DT:H5'	1.57	0.85
3:A:98:LYS:HG3	4:B:192:ILE:HG22	1.59	0.85
1:C:1:DT:H2'	1:C:2:DA:C8	2.14	0.83
2:D:34:DT:H2''	2:D:35:DT:C5'	2.06	0.83
1:C:18:DA:H2''	1:C:19:DT:H5''	1.57	0.83
4:B:145:GLU:HG3	5:B:628:HOH:O	1.79	0.81
3:A:91:ARG:CZ	4:B:199:LEU:HD21	2.11	0.80
1:C:1:DT:H6	1:C:1:DT:O5'	1.64	0.79
3:A:84:PHE:HE1	4:B:199:LEU:HB3	1.49	0.78
1:C:17:DC:H5'	3:A:123:MET:CE	2.12	0.75
4:B:149:ALA:O	4:B:152:ILE:HG22	1.86	0.74

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:27:DT:H6	2:D:27:DT:H5'	1.50	0.74
3:A:84:PHE:CE1	4:B:199:LEU:HB3	2.23	0.73
1:C:1:DT:C2'	1:C:2:DA:C8	2.72	0.73
4:B:169:THR:HG23	4:B:171:LEU:HG	1.69	0.73
1:C:18:DA:C2'	1:C:19:DT:H5''	2.18	0.72
1:C:16:DA:H2''	1:C:17:DC:C5'	2.08	0.71
3:A:84:PHE:HD2	3:A:107:CYS:SG	2.15	0.69
4:B:174:ILE:HD12	4:B:174:ILE:H	1.57	0.69
3:A:77:ILE:HG22	3:A:82:ARG:HG2	1.73	0.69
1:C:17:DC:H6	3:A:123:MET:HE2	1.59	0.67
3:A:91:ARG:NH1	4:B:199:LEU:HD21	2.08	0.66
4:B:165:LEU:O	4:B:169:THR:HB	1.96	0.65
1:C:17:DC:H2''	1:C:18:DA:C8	2.33	0.63
4:B:131:TYR:CE2	4:B:134:HIS:HB2	2.33	0.63
5:C:650:HOH:O	4:B:131:TYR:CD2	2.51	0.63
2:D:27:DT:H2''	2:D:28:DG:C8	2.35	0.62
1:C:2:DA:H2''	1:C:3:DC:H6	1.65	0.61
1:C:17:DC:H6	3:A:123:MET:CE	2.13	0.61
4:B:144:LEU:HD13	4:B:179:TRP:CD2	2.35	0.61
3:A:77:ILE:HG22	3:A:82:ARG:CG	2.32	0.60
3:A:111:PRO:HA	3:A:114:VAL:CG1	2.31	0.60
4:B:162:LEU:HD11	4:B:173:ARG:HG3	1.84	0.59
4:B:192:ILE:HD11	4:B:197:ALA:N	2.17	0.59
3:A:77:ILE:CG2	3:A:82:ARG:HG2	2.33	0.58
1:C:2:DA:H2''	1:C:3:DC:C6	2.39	0.58
1:C:1:DT:H2'	1:C:2:DA:N7	2.19	0.57
3:A:118:PHE:O	3:A:122:ARG:HG3	2.04	0.57
2:D:22:DT:H5'	2:D:22:DT:H6	1.69	0.57
1:C:17:DC:C2'	1:C:18:DA:C8	2.87	0.57
4:B:192:ILE:HD13	4:B:200:LEU:HD22	1.86	0.56
4:B:144:LEU:HD13	4:B:179:TRP:CG	2.39	0.56
1:C:2:DA:H3'	4:B:177:LYS:HZ3	1.71	0.55
2:D:37:DT:H2''	2:D:38:DA:O5'	2.07	0.55
3:A:102:GLU:HB2	4:B:200:LEU:HD23	1.88	0.55
2:D:26:DA:C8	2:D:27:DT:H72	2.43	0.54
2:D:34:DT:H5'	2:D:34:DT:H6	1.73	0.54
4:B:166:MET:HG3	4:B:176:ILE:HD12	1.89	0.53
3:A:112:LEU:O	3:A:116:VAL:HG13	2.08	0.53
3:A:102:GLU:CB	4:B:200:LEU:HD23	2.38	0.52
2:D:35:DT:H2''	2:D:36:DT:O5'	2.09	0.52
2:D:27:DT:C2'	2:D:28:DG:C8	2.93	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:B:192:ILE:HD12	4:B:192:ILE:C	2.35	0.52
1:C:1:DT:O5'	1:C:1:DT:C6	2.50	0.51
4:B:129:LYS:O	4:B:131:TYR:CD1	2.64	0.51
3:A:84:PHE:CD2	3:A:107:CYS:SG	3.00	0.51
4:B:162:LEU:CD2	4:B:166:MET:SD	2.99	0.50
2:D:34:DT:C2'	2:D:35:DT:H5''	2.41	0.50
1:C:17:DC:C6	3:A:123:MET:HE2	2.43	0.50
3:A:105:LYS:HB3	3:A:105:LYS:NZ	2.27	0.50
3:A:110:THR:O	3:A:114:VAL:HG12	2.11	0.50
3:A:98:LYS:O	3:A:102:GLU:HG2	2.11	0.49
1:C:10:DA:H1'	4:B:133:GLY:HA3	1.94	0.49
5:C:650:HOH:O	4:B:131:TYR:HD2	1.94	0.49
2:D:27:DT:H5'	2:D:27:DT:C6	2.40	0.49
4:B:132:ARG:NH2	5:B:611:HOH:O	2.46	0.49
1:C:19:DT:H2''	1:C:20:DC:O5'	2.12	0.49
3:A:84:PHE:HD2	3:A:107:CYS:HG	1.61	0.49
1:C:1:DT:H2''	1:C:2:DA:C8	2.45	0.49
1:C:15:DT:H3	2:D:30:DA:H61	1.59	0.48
2:D:34:DT:C2'	2:D:35:DT:C5'	2.84	0.48
4:B:192:ILE:CD1	4:B:196:LEU:HB2	2.43	0.48
1:C:17:DC:C6	3:A:123:MET:CE	2.96	0.48
4:B:165:LEU:HD13	4:B:176:ILE:CG2	2.43	0.48
4:B:131:TYR:CZ	4:B:134:HIS:HB2	2.49	0.48
4:B:131:TYR:CD2	4:B:134:HIS:HB2	2.48	0.47
3:A:102:GLU:HG3	4:B:200:LEU:HD23	1.97	0.47
1:C:2:DA:H3'	4:B:177:LYS:NZ	2.30	0.47
2:D:25:DG:O6	3:A:124:ARG:NH2	2.48	0.46
2:D:35:DT:H5'	2:D:35:DT:C6	2.50	0.46
1:C:3:DC:H2'	5:C:602:HOH:O	2.15	0.46
4:B:134:HIS:ND1	4:B:134:HIS:C	2.73	0.46
1:C:4:DA:N7	5:C:602:HOH:O	2.35	0.46
4:B:139:GLU:O	4:B:142:ARG:N	2.48	0.46
4:B:162:LEU:HD21	4:B:166:MET:SD	2.55	0.46
5:D:630:HOH:O	3:A:96:ASN:HB2	2.15	0.46
4:B:151:ASN:N	4:B:151:ASN:ND2	2.64	0.46
4:B:192:ILE:O	4:B:192:ILE:HG13	2.15	0.45
3:A:94:SER:O	3:A:95:LEU:HD23	2.16	0.45
4:B:196:LEU:O	4:B:200:LEU:HD13	2.17	0.45
2:D:35:DT:H5'	2:D:35:DT:H6	1.83	0.44
1:C:17:DC:H2'	1:C:18:DA:C8	2.52	0.43
2:D:24:DT:H5''	3:A:82:ARG:HH12	1.82	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:B:203:GLU:CB	4:B:204:PRO:HD2	2.47	0.43
1:C:9:DA:H5'	4:B:132:ARG:NH1	2.33	0.43
3:A:89:PHE:HD1	3:A:118:PHE:CE2	2.36	0.43
4:B:151:ASN:N	4:B:151:ASN:HD22	2.16	0.43
4:B:182:ASN:OD1	4:B:185:ARG:NH1	2.49	0.43
2:D:29:DT:H2''	2:D:30:DA:C8	2.54	0.42
3:A:92:LYS:HD3	4:B:196:LEU:HD11	2.00	0.42
4:B:147:TRP:O	4:B:148:PHE:C	2.59	0.42
4:B:200:LEU:HD12	4:B:200:LEU:N	2.34	0.42
3:A:82:ARG:O	3:A:86:GLU:HG2	2.20	0.42
4:B:157:LEU:HD21	4:B:165:LEU:HD12	2.01	0.42
1:C:2:DA:C2'	1:C:3:DC:C6	3.03	0.41
4:B:188:LYS:HB2	4:B:188:LYS:HE3	1.75	0.41
3:A:81:ALA:HB1	3:A:107:CYS:HB3	2.02	0.41
4:B:179:TRP:CH2	4:B:183:ARG:HG2	2.56	0.41
4:B:147:TRP:CE3	4:B:148:PHE:HA	2.56	0.41
2:D:35:DT:O2	4:B:135:ARG:NH2	2.54	0.40
4:B:129:LYS:O	4:B:134:HIS:HD2	2.04	0.40
4:B:192:ILE:HD12	4:B:193:ALA:O	2.21	0.40
4:B:162:LEU:HD11	4:B:173:ARG:CG	2.51	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	47/61 (77%)	44 (94%)	3 (6%)	0	100	100
4	B	76/83 (92%)	66 (87%)	6 (8%)	4 (5%)	1	1
All	All	123/144 (85%)	110 (89%)	9 (7%)	4 (3%)	3	4

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	B	204	PRO
4	B	169	THR
4	B	202	GLY
4	B	155	PRO

5.3.2 Protein sidechains ⓘ

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	41/56 (73%)	37 (90%)	4 (10%)	7	16
4	B	60/76 (79%)	53 (88%)	7 (12%)	5	11
All	All	101/132 (76%)	90 (89%)	11 (11%)	6	13

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	A	97	SER
3	A	105	LYS
3	A	114	VAL
3	A	116	VAL
4	B	134	HIS
4	B	151	ASN
4	B	169	THR
4	B	174	ILE
4	B	188	LYS
4	B	192	ILE
4	B	195	GLU

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

Mol	Chain	Res	Type
4	B	140	ASN
4	B	151	ASN
4	B	168	ASN

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.