Full wwPDB X-ray Structure Validation Report ⓘ

Apr 15, 2026 – 12:35 AM UTC

PDB ID	:	9O6B / pdb_00009o6b
Title	:	X-Ray structure of F240L mutant HOXB13 in complex with DNA (CAA)
Authors	:	Dikbas, U.M.; Wong, J.T.; Chen, Y.S.; Lallous, N.; Van Petegem, F.; Lack, N.A.
Deposited on	:	2025-04-11
Resolution	:	1.95 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:

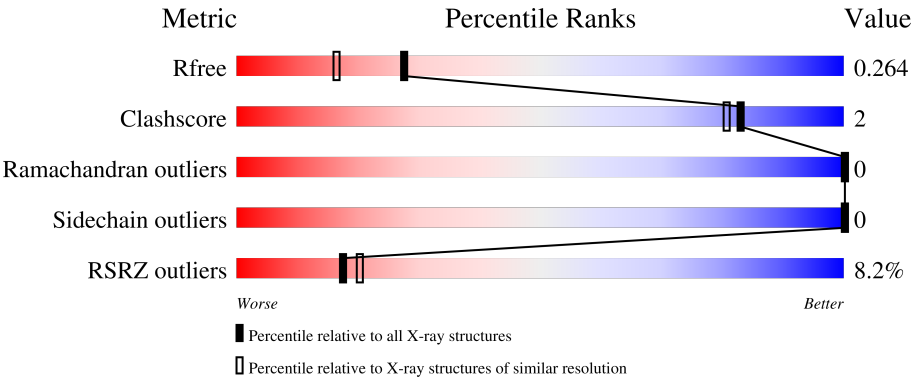
MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.95 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))
R_{free}	180053	3494 (1.96-1.96)
Clashscore	190562	3612 (1.96-1.96)
Ramachandran outliers	187476	3587 (1.96-1.96)
Sidechain outliers	187428	3587 (1.96-1.96)
RSRZ outliers	180081	3495 (1.96-1.96)

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	101	9% 56% 40%
1	J	101	7% 60% 40%
2	B	18	100%
2	K	18	100%
3	C	18	56% 44%

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Mol	Chain	Length	Quality of chain
3	L	18	

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 2551 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 protein called Homeobox protein Hox-B13.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
1	J	61	Total	C	N	O	0	0	0
			479	305	87	87			
1	A	61	Total	C	N	O	0	0	0
			477	302	88	87			

There are 68 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
J	184	MET	-	initiating methionine	UNP Q92826
J	185	GLY	-	expression tag	UNP Q92826
J	186	SER	-	expression tag	UNP Q92826
J	187	SER	-	expression tag	UNP Q92826
J	188	HIS	-	expression tag	UNP Q92826
J	189	HIS	-	expression tag	UNP Q92826
J	190	HIS	-	expression tag	UNP Q92826
J	191	HIS	-	expression tag	UNP Q92826
J	192	HIS	-	expression tag	UNP Q92826
J	193	HIS	-	expression tag	UNP Q92826
J	194	SER	-	expression tag	UNP Q92826
J	195	SER	-	expression tag	UNP Q92826
J	196	GLY	-	expression tag	UNP Q92826
J	197	LEU	-	expression tag	UNP Q92826
J	198	VAL	-	expression tag	UNP Q92826
J	199	PRO	-	expression tag	UNP Q92826
J	200	ARG	-	expression tag	UNP Q92826
J	201	GLY	-	expression tag	UNP Q92826
J	202	SER	-	expression tag	UNP Q92826
J	203	HIS	-	expression tag	UNP Q92826
J	204	MET	-	expression tag	UNP Q92826
J	205	ALA	-	expression tag	UNP Q92826
J	206	SER	-	expression tag	UNP Q92826
J	207	MET	-	expression tag	UNP Q92826
J	208	THR	-	expression tag	UNP Q92826

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Chain	Residue	Modelled	Actual	Comment	Reference
J	209	GLY	-	expression tag	UNP Q92826
J	210	GLY	-	expression tag	UNP Q92826
J	211	GLN	-	expression tag	UNP Q92826
J	212	GLN	-	expression tag	UNP Q92826
J	213	MET	-	expression tag	UNP Q92826
J	214	GLY	-	expression tag	UNP Q92826
J	215	ARG	-	expression tag	UNP Q92826
J	216	MET	-	expression tag	UNP Q92826
J	240	LEU	PHE	engineered mutation	UNP Q92826
A	184	MET	-	initiating methionine	UNP Q92826
A	185	GLY	-	expression tag	UNP Q92826
A	186	SER	-	expression tag	UNP Q92826
A	187	SER	-	expression tag	UNP Q92826
A	188	HIS	-	expression tag	UNP Q92826
A	189	HIS	-	expression tag	UNP Q92826
A	190	HIS	-	expression tag	UNP Q92826
A	191	HIS	-	expression tag	UNP Q92826
A	192	HIS	-	expression tag	UNP Q92826
A	193	HIS	-	expression tag	UNP Q92826
A	194	SER	-	expression tag	UNP Q92826
A	195	SER	-	expression tag	UNP Q92826
A	196	GLY	-	expression tag	UNP Q92826
A	197	LEU	-	expression tag	UNP Q92826
A	198	VAL	-	expression tag	UNP Q92826
A	199	PRO	-	expression tag	UNP Q92826
A	200	ARG	-	expression tag	UNP Q92826
A	201	GLY	-	expression tag	UNP Q92826
A	202	SER	-	expression tag	UNP Q92826
A	203	HIS	-	expression tag	UNP Q92826
A	204	MET	-	expression tag	UNP Q92826
A	205	ALA	-	expression tag	UNP Q92826
A	206	SER	-	expression tag	UNP Q92826
A	207	MET	-	expression tag	UNP Q92826
A	208	THR	-	expression tag	UNP Q92826
A	209	GLY	-	expression tag	UNP Q92826
A	210	GLY	-	expression tag	UNP Q92826
A	211	GLN	-	expression tag	UNP Q92826
A	212	GLN	-	expression tag	UNP Q92826
A	213	MET	-	expression tag	UNP Q92826
A	214	GLY	-	expression tag	UNP Q92826
A	215	ARG	-	expression tag	UNP Q92826
A	216	MET	-	expression tag	UNP Q92826

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Chain	Residue	Modelled	Actual	Comment	Reference
A	240	LEU	PHE	engineered mutation	UNP Q92826

- Molecule 2 is a DNA chain called DNA-TTGTGTTTTATTGGGTCC.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	K	18	Total	C	N	O	P	0	0	0
			366	178	56	115	17			
2	B	18	Total	C	N	O	P	0	0	0
			366	178	56	115	17			

- Molecule 3 is a DNA chain called DNA-GGACCCAATAAAACACAA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	L	18	Total	C	N	O	P	0	0	0
			366	175	77	97	17			
3	C	18	Total	C	N	O	P	0	0	0
			366	175	77	97	17			

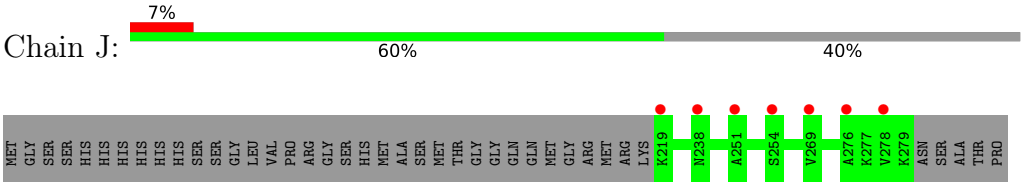
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	J	31	Total	O	0	0
			31	31		
4	K	19	Total	O	0	0
			19	19		
4	L	15	Total	O	0	0
			15	15		
4	A	23	Total	O	0	0
			23	23		
4	B	25	Total	O	0	0
			25	25		
4	C	18	Total	O	0	0
			18	18		

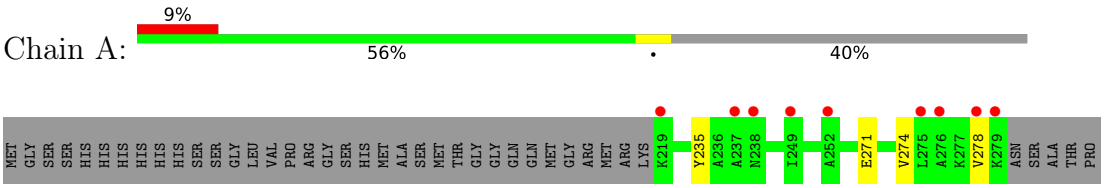
3 Residue-property plots (i)

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 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: Homeobox protein Hox-B13



• Molecule 1: Homeobox protein Hox-B13



• Molecule 2: DNA-TTGTGTTTTATTGGGTCC

There are no outlier residues recorded for this chain.

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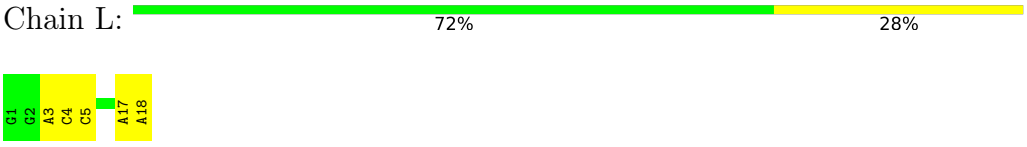
There are no outlier residues recorded for this chain.

• Molecule 3: DNA-GGACCCAATAAAACACAA



• Molecule 3: DNA-GGACCCAATAAAACACAA

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	113.22Å 57.82Å 75.49Å 90.00° 119.00° 90.00°	Depositor
Resolution (Å)	33.01 – 1.95 33.01 – 1.95	Depositor EDS
% Data completeness (in resolution range)	97.8 (33.01-1.95) 97.6 (33.01-1.95)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.86 (at 1.95Å)	Xtriage
Refinement program	PHENIX 1.18.2_3874	Depositor
R, R_{free}	0.226 , 0.273 0.218 , 0.264	Depositor DCC
R_{free} test set	1564 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å^2)	43.0	Xtriage
Anisotropy	0.327	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.39 , 47.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	2551	wwPDB-VP
Average B, all atoms (Å^2)	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.89% of the height of the origin peak. No significant pseudotranslation is detected.*

[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

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	0.28	0/482	0.41	0/649
1	J	0.29	0/484	0.44	0/650
2	B	0.37	0/407	0.63	0/628
2	K	0.37	0/407	0.60	0/628
3	C	0.36	0/413	0.52	0/634
3	L	0.37	0/413	0.51	0/634
All	All	0.34	0/2606	0.52	0/3823

There are no bond length outliers.

There are no bond angle outliers.

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	477	0	470	2	0
1	J	479	0	478	0	0
2	B	366	0	210	0	0
2	K	366	0	210	0	0
3	C	366	0	201	5	0
3	L	366	0	201	3	0
4	A	23	0	0	0	0
4	B	25	0	0	0	0
4	C	18	0	0	0	0
4	J	31	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	K	19	0	0	0	0
4	L	15	0	0	0	0
All	All	2551	0	1770	10	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 2.

All (10) 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)
3:L:3:DA:H2"	3:L:4:DC:H5"	1.78	0.65
3:L:17:DA:H2"	3:L:18:DA:H5"	1.78	0.64
3:C:3:DA:H2'	3:C:4:DC:C6	2.47	0.50
1:A:235:TYR:OH	1:A:271:GLU:OE1	2.29	0.47
3:C:14:DC:H2"	3:C:15:DA:C8	2.50	0.46
3:L:4:DC:H2'	3:L:5:DC:C6	2.51	0.46
3:C:6:DC:H2"	3:C:7:DA:O5'	2.15	0.46
3:C:4:DC:H6	3:C:4:DC:H5"	1.81	0.45
3:C:10:DA:H2"	3:C:11:DA:C8	2.53	0.43
1:A:274:VAL:O	1:A:278:VAL:HG23	2.20	0.41

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	
1	A	59/101 (58%)	59 (100%)	0	0	100	100
1	J	59/101 (58%)	59 (100%)	0	0	100	100
All	All	118/202 (58%)	118 (100%)	0	0	100	100

There are no Ramachandran outliers to report.

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	
1	A	45/87 (52%)	45 (100%)	0	100	100
1	J	45/87 (52%)	45 (100%)	0	100	100
All	All	90/174 (52%)	90 (100%)	0	100	100

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

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA

There are no RNA molecules 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 oligosaccharides in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

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

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, 95^{th} 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(Å^2)	Q<0.9
1	A	61/101 (60%)	1.16	9 (14%) 5 6	37, 45, 60, 76	0
1	J	61/101 (60%)	0.96	7 (11%) 9 11	37, 44, 61, 77	0
2	B	18/18 (100%)	0.45	0 100 100	38, 49, 58, 58	0
2	K	18/18 (100%)	0.56	0 100 100	40, 51, 63, 64	0
3	C	18/18 (100%)	0.35	0 100 100	41, 49, 57, 59	0
3	L	18/18 (100%)	0.45	0 100 100	43, 50, 56, 56	0
All	All	194/274 (70%)	0.83	16 (8%) 17 20	37, 47, 62, 77	0

All (16) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	278	VAL	5.1
1	A	275	LEU	4.2
1	J	278	VAL	3.6
1	A	238	ASN	2.8
1	A	252	ALA	2.8
1	J	219	LYS	2.7
1	A	279	LYS	2.6
1	J	276	ALA	2.5
1	J	251	ALA	2.5
1	J	269	VAL	2.5
1	A	276	ALA	2.4
1	A	237	ALA	2.3
1	A	249	ILE	2.2
1	J	238	ASN	2.1
1	A	219	LYS	2.1
1	J	254	SER	2.0

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates (i)

There are no oligosaccharides in this entry.

6.4 Ligands (i)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.