



Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 2APO / pdb_00002apo
Title : Crystal Structure of the Methanococcus jannaschii Cbf5 Nop10 Complex
Authors : Hamma, T.; Reichow, S.L.; Varani, G.; Ferre-D'Amare, A.R.
Deposited on : 2005-08-16
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
Mogul : 2022.3.0, CSD as543be (2022)
Xtrriage (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

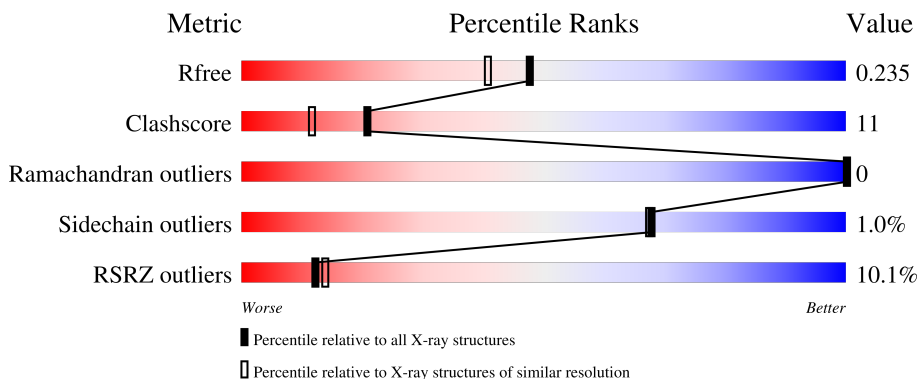
1 Overall quality at a glance

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 $\leq 5\%$. 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	357	
2	B	60	

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 3019 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 Probable tRNA pseudouridine synthase B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	304	2405	1536	407	449	13	0	4	0

There are 21 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-20	MET	-	cloning artifact	UNP Q57612
A	-19	GLY	-	cloning artifact	UNP Q57612
A	-18	HIS	-	expression tag	UNP Q57612
A	-17	HIS	-	expression tag	UNP Q57612
A	-16	HIS	-	expression tag	UNP Q57612
A	-15	HIS	-	expression tag	UNP Q57612
A	-14	HIS	-	expression tag	UNP Q57612
A	-13	HIS	-	expression tag	UNP Q57612
A	-12	HIS	-	expression tag	UNP Q57612
A	-11	HIS	-	expression tag	UNP Q57612
A	-10	HIS	-	expression tag	UNP Q57612
A	-9	HIS	-	expression tag	UNP Q57612
A	-8	SER	-	cloning artifact	UNP Q57612
A	-7	SER	-	cloning artifact	UNP Q57612
A	-6	GLY	-	cloning artifact	UNP Q57612
A	-5	HIS	-	cloning artifact	UNP Q57612
A	-4	ILE	-	cloning artifact	UNP Q57612
A	-3	GLU	-	cloning artifact	UNP Q57612
A	-2	GLY	-	cloning artifact	UNP Q57612
A	-1	ARG	-	cloning artifact	UNP Q57612
A	0	HIS	-	cloning artifact	UNP Q57612

- Molecule 2 is a protein called Ribosome biogenesis protein Nop10.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
2	B	55	Total	C	N	O	S	Se	0	3	0
			436	284	75	68	6	3			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	401	MSE	MET	modified residue	UNP P81303
B	404	MSE	MET	modified residue	UNP P81303
B	406	MSE	MET	modified residue	UNP P81303
B	448	MSE	MET	modified residue	UNP P81303

- Molecule 3 is POTASSIUM ION (CCD ID: K) (formula: K).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	K	0	0
			2	2		

- Molecule 4 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total	Zn	0	0
			1	1		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	157	Total	O	0	0
			157	157		
5	B	18	Total	O	0	0
			18	18		

4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	118.29Å 63.19Å 67.90Å 90.00° 102.62° 90.00°	Depositor
Resolution (Å)	49.17 – 1.95 49.17 – 1.95	Depositor EDS
% Data completeness (in resolution range)	94.4 (49.17-1.95) 94.5 (49.17-1.95)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.83 (at 1.95Å)	Xtrriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.202 , 0.230 0.207 , 0.235	Depositor DCC
R_{free} test set	6587 reflections (9.91%)	wwPDB-VP
Wilson B-factor (Å ²)	28.8	Xtrriage
Anisotropy	0.433	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 36.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3019	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.70% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, K

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	0.38	0/2447	0.89	7/3306 (0.2%)
2	B	0.55	1/443 (0.2%)	1.01	2/589 (0.3%)
All	All	0.41	1/2890 (0.0%)	0.91	9/3895 (0.2%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	442	TRP	NE1-CE2	-5.26	1.31	1.37

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	258	VAL	N-CA-C	8.13	118.19	110.30
1	A	38	LYS	N-CA-C	-7.43	100.70	110.43
1	A	110	VAL	N-CA-C	-6.86	98.56	108.17
1	A	104	ILE	CA-C-N	-5.94	114.27	120.38
1	A	104	ILE	C-N-CA	-5.94	114.27	120.38
2	B	432	LYS	N-CA-C	5.61	116.05	109.60
1	A	249	LYS	N-CA-C	-5.16	103.23	110.50
1	A	86	GLY	N-CA-C	5.07	119.00	111.76
2	B	454	LYS	N-CA-C	5.01	116.82	111.36

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	A	2405	0	2399	46	0
2	B	436	0	430	21	4
3	A	2	0	0	0	0
4	B	1	0	0	0	0
5	A	157	0	0	2	0
5	B	18	0	0	0	0
All	All	3019	0	2829	63	4

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 11.

All (63) 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:105:PRO:HG2	1:A:205:GLY:HA2	1.56	0.85
1:A:101:MET:HE2	1:A:248:LEU:HD11	1.58	0.85
1:A:166:ASP:OD2	2:B:404:MSE:HG3	1.86	0.75
2:B:424[B]:CYS:SG	2:B:425:GLY:N	2.57	0.73
2:B:412[A]:CYS:SG	2:B:414:LEU:HB3	2.29	0.72
1:A:53:PRO:HA	2:B:433[B]:PRO:HG2	1.76	0.67
1:A:101:MET:HE2	1:A:248:LEU:CD1	2.27	0.64
1:A:33:ASN:ND2	1:A:35:TYR:H	1.96	0.63
1:A:302:MET:HE3	1:A:314:VAL:O	1.99	0.62
1:A:30:TYR:CE2	1:A:329:PRO:HG3	2.35	0.62
1:A:19:ILE:HD11	1:A:277:LYS:HG2	1.82	0.62
1:A:101:MET:HE1	1:A:284:THR:HG21	1.82	0.61
1:A:203:LYS:HE3	5:A:750:HOH:O	2.01	0.60
1:A:53:PRO:HA	2:B:433[B]:PRO:CG	2.31	0.60
2:B:414:LEU:HD22	2:B:415:TYR:N	2.17	0.59
1:A:250:LYS:HD3	1:A:288:GLU:CD	2.30	0.57
1:A:126:ARG:HD2	1:A:130:GLU:OE2	2.06	0.55
2:B:445:TYR:CE2	2:B:449:LEU:HD11	2.42	0.54
1:A:153:LYS:H	1:A:174:GLN:HE21	1.56	0.54
1:A:302:MET:HB2	1:A:307[B]:ILE:HD11	1.89	0.53
1:A:301:LEU:HD12	1:A:314:VAL:HG12	1.93	0.51
2:B:409:CYS:HB3	2:B:412[A]:CYS:SG	2.51	0.50
1:A:105:PRO:HD3	1:A:247:HIS:CD2	2.46	0.50
2:B:404:MSE:HE1	2:B:417:LEU:HB3	1.94	0.50
1:A:198:GLU:OE2	2:B:405:ARG:HA	2.13	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:404:MSE:HE2	2:B:417:LEU:HD22	1.93	0.49
1:A:19:ILE:CD1	1:A:277:LYS:HG2	2.42	0.48
1:A:105:PRO:CG	1:A:205:GLY:HA2	2.36	0.48
2:B:448:MSE:CE	2:B:452:ALA:HB2	2.44	0.48
1:A:302:MET:SD	1:A:307[B]:ILE:HD13	2.53	0.47
2:B:414:LEU:HD22	2:B:414:LEU:C	2.39	0.47
1:A:101:MET:CE	1:A:248:LEU:HD11	2.39	0.46
2:B:414:LEU:CD2	2:B:415:TYR:N	2.78	0.46
1:A:137:GLN:O	1:A:150:ARG:N	2.49	0.46
2:B:448:MSE:HE2	2:B:452:ALA:HB2	1.98	0.46
2:B:454:LYS:C	2:B:456:LYS:H	2.23	0.46
1:A:27:ASN:OD1	1:A:29:ASP:HB2	2.16	0.45
1:A:302:MET:HB2	1:A:307[B]:ILE:CD1	2.47	0.45
1:A:296:ALA:HB1	1:A:320:ARG:O	2.17	0.45
1:A:71:LEU:CD1	1:A:92:LEU:HD22	2.47	0.44
1:A:128:PHE:HA	1:A:157:LEU:HD23	2.00	0.44
1:A:30:TYR:CZ	1:A:329:PRO:HG3	2.52	0.44
1:A:114:HIS:HE1	5:A:621:HOH:O	1.99	0.44
1:A:57:THR:OG1	1:A:60:GLU:HG3	2.18	0.43
1:A:249:LYS:HG3	1:A:283:GLU:OE1	2.17	0.43
1:A:250:LYS:HD3	1:A:288:GLU:OE1	2.19	0.43
1:A:19:ILE:HG21	1:A:308:LEU:HD11	2.00	0.43
2:B:414:LEU:HD22	2:B:415:TYR:O	2.19	0.43
1:A:192:THR:OG1	1:A:193:SER:N	2.52	0.42
1:A:297:VAL:HG13	1:A:322:TYR:CE1	2.54	0.42
1:A:71:LEU:HD11	1:A:92:LEU:HD22	2.02	0.42
1:A:302:MET:HE3	1:A:314:VAL:C	2.44	0.42
2:B:404:MSE:HE2	2:B:404:MSE:HB3	1.70	0.42
1:A:114:HIS:HD2	1:A:166:ASP:OD1	2.02	0.42
1:A:195:HIS:NE2	1:A:197:GLN:NE2	2.68	0.41
2:B:432:LYS:HA	2:B:433[A]:PRO:HD3	1.88	0.41
2:B:407:LYS:HD3	2:B:430:ILE:HD13	2.02	0.41
1:A:24[A]:VAL:HG12	1:A:25:GLU:N	2.35	0.41
1:A:136:TYR:CE2	1:A:151:ILE:HG12	2.56	0.41
1:A:225:TRP:CZ3	1:A:226:LYS:HE2	2.55	0.41
2:B:414:LEU:CD2	2:B:415:TYR:O	2.69	0.41
1:A:33:ASN:ND2	1:A:35:TYR:HB2	2.37	0.40
1:A:39:ILE:HG23	1:A:40:GLU:N	2.36	0.40

All (4) 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	Interatomic distance (Å)	Clash overlap (Å)
2:B:445:TYR:CE2	2:B:445:TYR:CE2[2_556]	1.43	0.77
2:B:445:TYR:CD2	2:B:445:TYR:CE2[2_556]	1.58	0.62
2:B:445:TYR:CD2	2:B:445:TYR:CD2[2_556]	1.76	0.44
2:B:445:TYR:CD2	2:B:445:TYR:CZ[2_556]	2.05	0.15

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	304/357 (85%)	296 (97%)	8 (3%)	0	100	100
2	B	56/60 (93%)	49 (88%)	7 (12%)	0	100	100
All	All	360/417 (86%)	345 (96%)	15 (4%)	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	
1	A	253/311 (81%)	253 (100%)	0	100	100
2	B	42/51 (82%)	39 (93%)	3 (7%)	13	4
All	All	295/362 (82%)	292 (99%)	3 (1%)	68	67

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	404	MSE
2	B	414	LEU
2	B	448	MSE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	33	ASN
1	A	76	HIS
1	A	114	HIS
1	A	174	GLN
1	A	197	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](#)

Of 3 ligands modelled in this entry, 3 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

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

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(Å ²)	Q<0.9
1	A	304/357 (85%)	0.25	16 (5%) 32 37	14, 33, 52, 69	4 (1%)
2	B	52/60 (86%)	1.57	20 (38%) 1 0	15, 44, 76, 91	3 (5%)
All	All	356/417 (85%)	0.44	36 (10%) 12 14	14, 34, 61, 91	7 (1%)

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	457	ASN	5.8
2	B	442	TRP	4.9
2	B	445	TYR	4.9
2	B	424[A]	CYS	4.4
1	A	151	ILE	4.2
2	B	425	GLY	4.1
2	B	412[A]	CYS	3.6
2	B	453	LEU	3.4
2	B	420	ILE	3.3
2	B	403	GLU	3.2
1	A	17	GLU	3.2
1	A	35	TYR	3.1
1	A	195	HIS	2.9
1	A	136	TYR	2.9
2	B	422	PRO	2.9
2	B	455	ASN	2.9
1	A	138	ARG	2.9
1	A	309	ASN	2.8
2	B	423	LYS	2.8
2	B	456	LYS	2.8
2	B	426	GLU	2.6
1	A	72	ASP	2.5
1	A	305	LYS	2.5
2	B	427	LYS	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	30	TYR	2.4
1	A	178	TYR	2.4
1	A	137	GLN	2.3
1	A	331	MET	2.3
1	A	135	ILE	2.3
2	B	454	LYS	2.2
2	B	414	LEU	2.2
2	B	410	PRO	2.2
2	B	419	GLU	2.2
2	B	421	CYS	2.2
1	A	150	ARG	2.1
1	A	229	GLY	2.1

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](#)

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
4	ZN	B	501	1/1	0.93	0.11	63,63,63,63	0
3	K	A	502	1/1	0.98	0.22	16,16,16,16	1
3	K	A	503	1/1	0.99	0.08	42,42,42,42	0

6.5 Other polymers [i](#)

There are no such residues in this entry.