Full wwPDB X-ray Structure Validation Report ⓘ

Apr 25, 2026 – 05:06 AM EDT

PDB ID	:	2C0E / pdb_00002c0e
Title	:	Structure of PDI-related Chaperone, Wind with his-tag on C-terminus.
Authors	:	Sevvana, M.; Ma, Q.; Barnewitz, K.; Guo, C.; Soling, H.-D.; Ferrari, D.M.; Sheldrick, G.M.
Deposited on	:	2005-09-01
Resolution	:	2.35 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:

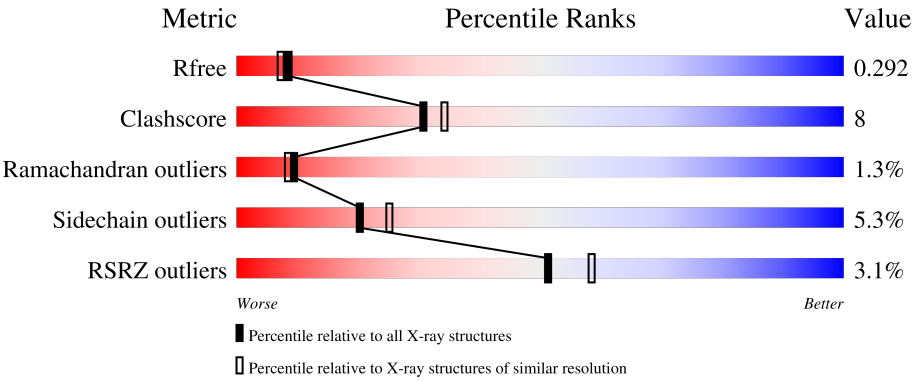
MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
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 2.35 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	1596 (2.36-2.36)
Clashscore	190562	1663 (2.36-2.36)
Ramachandran outliers	187476	1646 (2.36-2.36)
Sidechain outliers	187428	1646 (2.36-2.36)
RSRZ outliers	180081	1598 (2.36-2.36)

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	248	3%, 70%, 18%, 8%
1	B	248	3%, 71%, 16%, 10%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 3395 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 WINDBEUTEL PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	228	Total	C	N	O	S	0	0	0
			1709	1104	286	315	4			
1	B	224	Total	C	N	O	S	0	0	0
			1578	1017	264	293	4			

- Molecule 2 is water.

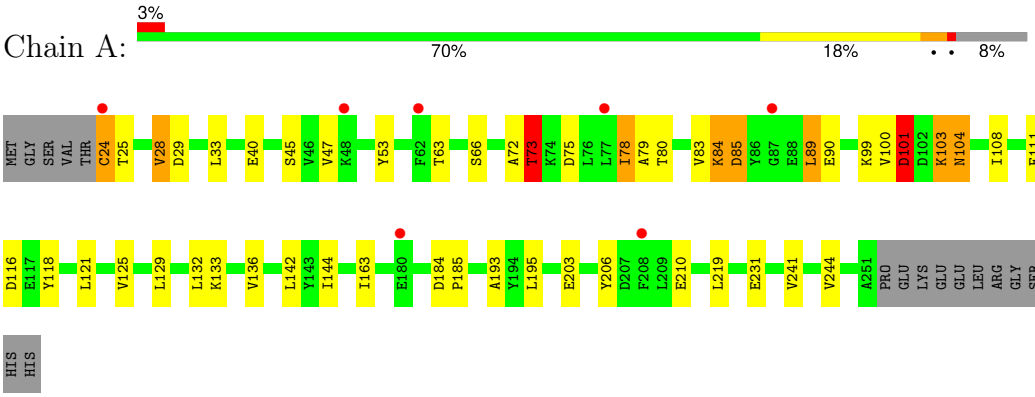
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	71	Total	O	0	0
			71	71		
2	B	37	Total	O	0	0
			37	37		

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.

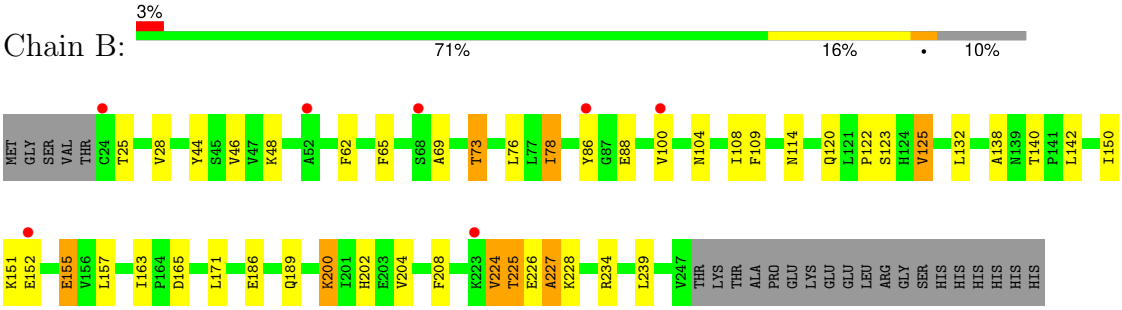
• Molecule 1: WINDBEUTEL PROTEIN

Chain A:



• Molecule 1: WINDBEUTEL PROTEIN

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	107.78Å 50.37Å 98.67Å 90.00° 112.19° 90.00°	Depositor
Resolution (Å)	20.00 – 2.35 20.00 – 2.35	Depositor EDS
% Data completeness (in resolution range)	98.4 (20.00-2.35) 98.2 (20.00-2.35)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	4.85 (at 2.36Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.226 , 0.293 0.223 , 0.292	Depositor DCC
R_{free} test set	1045 reflections (5.14%)	wwPDB-VP
Wilson B-factor (Å^2)	31.1	Xtriage
Anisotropy	0.159	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 39.8	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	0.91	EDS
Total number of atoms	3395	wwPDB-VP
Average B, all atoms (Å^2)	19.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.35% 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	1.55	10/1742 (0.6%)	1.35	15/2360 (0.6%)
1	B	1.33	4/1610 (0.2%)	1.39	8/2185 (0.4%)
All	All	1.45	14/3352 (0.4%)	1.37	23/4545 (0.5%)

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
1	A	0	1

All (14) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	53	TYR	CA-CB	9.40	1.59	1.52
1	A	28	VAL	CA-CB	7.91	1.63	1.54
1	A	241	VAL	CA-CB	6.48	1.62	1.54
1	B	125	VAL	CA-CB	6.21	1.61	1.54
1	B	62	PHE	N-CA	5.94	1.53	1.46
1	A	219	LEU	CA-C	5.77	1.60	1.52
1	A	45	SER	C-O	-5.68	1.17	1.23
1	A	108	ILE	CA-CB	5.62	1.60	1.54
1	A	195	LEU	C-O	-5.45	1.17	1.24
1	A	193	ALA	CA-CB	5.42	1.61	1.53
1	A	203	GLU	C-O	-5.34	1.18	1.24
1	A	193	ALA	C-O	-5.26	1.17	1.24
1	B	78	ILE	CB-CG2	5.14	1.69	1.52
1	B	150	ILE	CA-CB	5.02	1.60	1.54

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	228	LYS	N-CA-C	-8.30	101.77	112.23
1	A	184	ASP	CA-C-N	7.16	126.69	119.24
1	A	184	ASP	C-N-CA	7.16	126.69	119.24
1	A	73	THR	N-CA-C	6.94	120.71	109.40
1	A	115	ALA	N-CA-C	-6.60	105.21	113.20
1	B	150	ILE	N-CA-C	-6.29	98.56	107.75
1	B	88	GLU	N-CA-C	-6.21	98.41	108.41
1	A	85	ASP	N-CA-C	5.86	118.41	109.62
1	A	99	LYS	N-CA-C	5.82	119.59	111.90
1	A	101	ASP	N-CA-CB	-5.77	100.69	111.13
1	B	239	LEU	N-CA-C	5.63	118.19	111.71
1	B	163	ILE	CA-C-N	-5.61	114.48	120.03
1	B	163	ILE	C-N-CA	-5.61	114.48	120.03
1	A	25	THR	CB-CA-C	5.56	118.90	109.84
1	A	136	VAL	N-CA-C	5.55	115.68	110.30
1	B	138	ALA	N-CA-C	-5.55	106.01	112.89
1	B	140	THR	CB-CA-C	-5.37	103.02	110.37
1	A	163	ILE	CA-C-N	5.21	125.21	119.89
1	A	163	ILE	C-N-CA	5.21	125.21	119.89
1	A	203	GLU	N-CA-C	5.07	116.61	111.14
1	A	104	ASN	N-CA-C	5.04	117.27	110.06
1	A	103	LYS	CA-C-N	-5.02	114.44	122.62
1	A	103	LYS	C-N-CA	-5.02	114.44	122.62

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	100	VAL	Peptide

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	1709	0	1603	25	0
1	B	1578	0	1361	29	0
2	A	71	0	0	6	0
2	B	37	0	0	7	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	3395	0	2964	52	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 8.

All (52) 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:72:ALA:HB2	2:A:2024:HOH:O	1.63	0.99
1:B:73:THR:HG23	2:B:2018:HOH:O	1.73	0.88
1:B:226:GLU:CA	1:B:227:ALA:HB3	2.04	0.87
1:A:73:THR:HG22	1:A:75:ASP:H	1.41	0.84
1:A:85:ASP:CA	2:A:2027:HOH:O	2.33	0.77
1:B:226:GLU:CA	1:B:227:ALA:CB	2.64	0.75
1:B:165:ASP:HB3	1:B:202:HIS:HE1	1.52	0.75
1:A:101:ASP:OD1	1:A:101:ASP:O	2.06	0.74
1:B:151:LYS:O	1:B:155:GLU:HG2	1.88	0.72
1:A:101:ASP:OD2	2:A:2029:HOH:O	2.08	0.70
1:B:157:LEU:CG	2:B:2027:HOH:O	2.46	0.63
1:B:224:VAL:O	1:B:225:THR:O	2.19	0.60
1:B:200:LYS:HG3	1:B:208:PHE:CE1	2.39	0.57
1:A:121:LEU:HD11	1:A:125:VAL:HG11	1.86	0.56
1:A:210:GLU:CB	2:A:2056:HOH:O	2.53	0.56
1:B:226:GLU:O	2:B:2036:HOH:O	2.17	0.56
1:A:133:LYS:HE2	1:A:144:ILE:HG22	1.88	0.54
1:A:111:PHE:CD2	1:A:118:TYR:HB3	2.42	0.53
1:B:69:ALA:O	1:B:73:THR:HG22	2.09	0.53
1:A:66:SER:HB2	1:A:78:ILE:HG21	1.91	0.52
1:A:133:LYS:HE2	1:A:144:ILE:CG2	2.39	0.52
1:A:83:VAL:O	1:A:84:LYS:C	2.52	0.51
1:B:157:LEU:HB2	2:B:2027:HOH:O	2.09	0.50
1:A:104:ASN:HB2	2:A:2029:HOH:O	2.12	0.49
1:A:29:ASP:OD1	1:A:80:THR:OG1	2.23	0.48
1:B:157:LEU:CB	2:B:2027:HOH:O	2.60	0.48
1:B:152:GLU:HA	1:B:155:GLU:HG3	1.95	0.48
1:A:24:CYS:HB3	1:A:63:THR:OG1	2.13	0.48
1:A:73:THR:HG21	1:A:142:LEU:HD13	1.96	0.47
1:B:165:ASP:HB3	1:B:202:HIS:CE1	2.40	0.47
1:A:114:ASN:C	1:A:116:ASP:H	2.22	0.47
1:B:186:GLU:O	1:B:189:GLN:HB2	2.15	0.46
1:A:47:VAL:HA	1:A:79:ALA:O	2.16	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:85:ASP:N	2:A:2027:HOH:O	2.46	0.46
1:A:40:GLU:HA	1:A:113:GLY:O	2.16	0.46
1:B:48:LYS:HG3	1:B:108:ILE:CD1	2.46	0.45
1:B:46:VAL:HG11	1:B:65:PHE:HE2	1.82	0.45
1:B:46:VAL:HG11	1:B:65:PHE:CE2	2.52	0.45
1:B:114:ASN:CG	2:B:2024:HOH:O	2.60	0.44
1:B:48:LYS:HG3	1:B:108:ILE:HD13	1.99	0.44
1:B:44:TYR:CD2	1:B:142:LEU:HD11	2.53	0.43
1:A:89:LEU:O	1:A:90:GLU:C	2.60	0.43
1:A:33:LEU:HD12	1:B:25:THR:HG22	2.01	0.43
1:B:86:TYR:CA	2:B:2019:HOH:O	2.67	0.43
1:B:100:VAL:HA	1:B:104:ASN:OD1	2.19	0.42
1:B:189:GLN:HE22	1:B:234:ARG:HH21	1.67	0.42
1:A:101:ASP:C	1:A:103:LYS:H	2.28	0.42
1:B:109:PHE:CE2	1:B:120:GLN:HG3	2.54	0.42
1:A:206:TYR:CE1	1:A:244:VAL:HG22	2.55	0.42
1:B:122:PRO:HB2	1:B:125:VAL:HG23	2.02	0.41
1:A:28:VAL:HG13	1:B:28:VAL:HG13	2.02	0.41
1:B:73:THR:HG21	1:B:76:LEU:HB3	2.02	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	226/248 (91%)	218 (96%)	6 (3%)	2 (1%)	14 14
1	B	222/248 (90%)	203 (91%)	15 (7%)	4 (2%)	6 5
All	All	448/496 (90%)	421 (94%)	21 (5%)	6 (1%)	9 8

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	89	LEU
1	B	123	SER
1	B	224	VAL
1	B	225	THR
1	A	84	LYS
1	B	227	ALA

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	159/218 (73%)	151 (95%)	8 (5%)	22	27
1	B	126/218 (58%)	119 (94%)	7 (6%)	19	23
All	All	285/436 (65%)	270 (95%)	15 (5%)	20	25

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	24	CYS
1	A	73	THR
1	A	78	ILE
1	A	101	ASP
1	A	129	LEU
1	A	132	LEU
1	A	185	PRO
1	A	231	GLU
1	B	73	THR
1	B	78	ILE
1	B	132	LEU
1	B	155	GLU
1	B	171	LEU
1	B	200	LYS
1	B	204	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	189	GLN

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

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	227/248 (91%)	-0.09	7 (3%) 51 58	1, 15, 33, 56	0
1	B	224/248 (90%)	0.18	7 (3%) 51 58	4, 23, 50, 62	0
All	All	451/496 (90%)	0.04	14 (3%) 51 58	1, 19, 47, 62	0

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	77	LEU	4.2
1	A	62	PHE	3.3
1	B	100	VAL	2.9
1	B	86	TYR	2.8
1	B	24	CYS	2.4
1	A	24	CYS	2.4
1	A	48	LYS	2.4
1	B	223	LYS	2.3
1	B	52	ALA	2.2
1	A	87	GLY	2.2
1	A	180	GLU	2.1
1	B	68	SER	2.0
1	A	208	PHE	2.0
1	B	152	GLU	2.0

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

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

6.3 Carbohydrates

There are no oligosaccharides in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.