



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 04:34 AM UTC

PDB ID : 2JIJ / pdb_00002jjj
Title : Crystal structure of the apo form of Chlamydomonas reinhardtii prolyl- 4
hydroxylase type I
Authors : Koski, M.K.; Hieta, R.; Bollner, C.; Kivirikko, K.I.; Myllyharju, J.; Wierenga,
R.K.
Deposited on : 2007-06-28
Resolution : 2.90 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

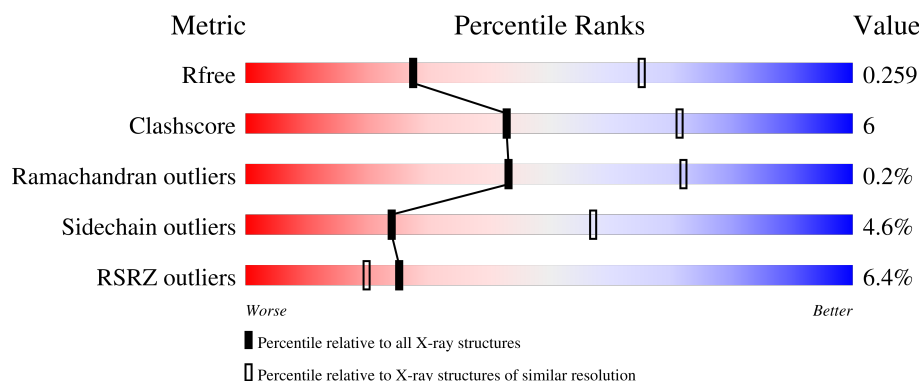
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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	2481 (2.90-2.90)
Clashscore	190562	2690 (2.90-2.90)
Ramachandran outliers	187476	2623 (2.90-2.90)
Sidechain outliers	187428	2625 (2.90-2.90)
RSRZ outliers	180081	2481 (2.90-2.90)

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	233	<div> <div>3%</div> <div>69%</div> <div>18%</div> <div>12%</div> </div>
1	B	233	<div> <div>4%</div> <div>70%</div> <div>13%</div> <div>15%</div> </div>
1	C	233	<div> <div>9%</div> <div>70%</div> <div>10%</div> <div>20%</div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4673 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 PROLYL-4 HYDROXYLASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	206	Total	C	N	O	S	0	0	0
			1623	1034	278	302	9			
1	B	199	Total	C	N	O	S	0	0	0
			1561	997	263	292	9			
1	C	187	Total	C	N	O	S	0	0	0
			1456	928	250	269	9			

- Molecule 2 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Cl	0	0
			1	1		
2	C	1	Total	Cl	0	0
			1	1		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	14	Total	O	0	0
			14	14		
3	B	12	Total	O	0	0
			12	12		
3	C	5	Total	O	0	0
			5	5		

• Molecule 1: PROLYL-4 HYDROXYLASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	98.32Å 117.46Å 72.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	33.83 – 2.90 33.83 – 2.90	Depositor EDS
% Data completeness (in resolution range)	98.8 (33.83-2.90) 98.7 (33.83-2.90)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.83 (at 2.90Å)	Xtriage
Refinement program	REFMAC 5.3.0028	Depositor
R, R_{free}	0.212 , 0.261 0.212 , 0.259	Depositor DCC
R_{free} test set	960 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å ²)	48.2	Xtriage
Anisotropy	0.088	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 55.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.89	EDS
Total number of atoms	4673	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.94% 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

5.1 Standard geometry

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

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	0.98	0/1666	1.21	13/2253 (0.6%)
1	B	0.98	0/1602	1.10	7/2168 (0.3%)
1	C	0.82	0/1493	0.99	4/2020 (0.2%)
All	All	0.93	0/4761	1.11	24/6441 (0.4%)

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	3
1	B	0	1
All	All	0	4

There are no bond length outliers.

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	233	LEU	N-CA-C	-17.60	89.77	113.18
1	A	173	GLU	N-CA-C	-11.75	85.78	110.80
1	A	236	ASP	N-CA-C	8.60	123.33	108.02
1	B	141	GLU	N-CA-C	8.01	120.98	109.84
1	A	39	ARG	CG-CD-NE	7.31	128.09	112.00
1	A	232	THR	CB-CA-C	-6.55	98.95	109.75
1	B	120	MET	CA-C-N	-6.49	117.69	123.33
1	B	120	MET	C-N-CA	-6.49	117.69	123.33
1	C	180	LEU	CA-C-N	6.32	126.53	119.32
1	C	180	LEU	C-N-CA	6.32	126.53	119.32
1	C	120	MET	CA-C-N	-5.93	118.17	123.33

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	120	MET	C-N-CA	-5.93	118.17	123.33
1	A	120	MET	CA-C-N	-5.86	118.24	123.33
1	A	120	MET	C-N-CA	-5.86	118.24	123.33
1	B	141	GLU	CA-C-N	5.63	126.88	119.84
1	B	141	GLU	C-N-CA	5.63	126.88	119.84
1	B	180	LEU	CA-C-N	5.58	125.69	119.32
1	B	180	LEU	C-N-CA	5.58	125.69	119.32
1	A	173	GLU	N-CA-CB	5.51	119.81	110.49
1	A	161	ARG	CA-C-N	-5.39	117.43	122.66
1	A	161	ARG	C-N-CA	-5.39	117.43	122.66
1	A	172	VAL	CB-CA-C	-5.24	102.51	110.95
1	A	180	LEU	CA-C-N	5.24	125.30	119.32
1	A	180	LEU	C-N-CA	5.24	125.30	119.32

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	172	VAL	Peptide
1	A	232	THR	Peptide
1	A	35	LYS	Peptide
1	B	189	GLY	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	1623	0	1581	27	0
1	B	1561	0	1515	18	0
1	C	1456	0	1425	14	1
2	A	1	0	0	0	0
2	C	1	0	0	0	0
3	A	14	0	0	0	0
3	B	12	0	0	0	0
3	C	5	0	0	0	0
All	All	4673	0	4521	57	1

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 6.

All (57) 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:76:LYS:HA	1:B:96:THR:HG22	1.58	0.85
1:A:76:LYS:HA	1:A:96:THR:HG22	1.57	0.84
1:B:33:GLU:H	1:B:33:GLU:CD	1.95	0.75
1:A:157:HIS:ND1	1:C:157:HIS:ND1	2.36	0.73
1:A:141:GLU:HA	1:A:141:GLU:OE1	1.90	0.72
1:B:37:GLU:HA	1:B:37:GLU:OE1	1.89	0.72
1:B:189:GLY:HA2	1:B:192:TRP:HD1	1.63	0.64
1:B:115:VAL:HG13	1:B:165:MET:HE3	1.79	0.63
1:B:150:PRO:HB3	1:B:160:GLN:HE21	1.67	0.60
1:A:147:PHE:C	1:A:149:ASP:H	2.09	0.58
1:A:93:ARG:HD3	1:A:140:TYR:CE2	2.38	0.58
1:A:76:LYS:CA	1:A:96:THR:HG22	2.33	0.57
1:A:93:ARG:NE	1:C:149:ASP:OD2	2.25	0.57
1:A:115:VAL:HG13	1:A:165:MET:HE3	1.88	0.56
1:B:190:ASP:N	1:B:190:ASP:OD1	2.38	0.55
1:C:164:THR:HG1	1:C:243:TRP:CD1	2.25	0.55
1:A:144:TYR:CE2	1:A:226:LEU:HB2	2.43	0.54
1:A:146:TYR:CZ	1:A:221:ASN:HB3	2.43	0.53
1:A:38:TRP:HZ2	1:A:55:LYS:O	1.91	0.53
1:A:149:ASP:OD1	1:A:149:ASP:C	2.52	0.52
1:B:191:GLY:O	1:B:203:LYS:CE	2.59	0.51
1:C:38:TRP:HZ2	1:C:55:LYS:O	1.94	0.51
1:B:146:TYR:CZ	1:B:221:ASN:HB3	2.47	0.50
1:A:39:ARG:HG3	1:A:39:ARG:HH11	1.75	0.50
1:C:101:ALA:O	1:C:104:GLU:HB2	2.11	0.50
1:A:187:VAL:O	1:A:188:THR:HG23	2.12	0.49
1:B:140:TYR:HE2	1:B:143:HIS:CE1	2.32	0.48
1:C:190:ASP:N	1:C:190:ASP:OD1	2.46	0.48
1:C:161:ARG:NH2	1:C:243:TRP:CE3	2.82	0.47
1:B:145:ASP:OD1	1:B:227:HIS:CE1	2.68	0.46
1:B:42:VAL:HG22	1:B:54:LEU:HD22	1.98	0.46
1:B:101:ALA:O	1:B:104:GLU:HB2	2.16	0.46
1:A:42:VAL:HG22	1:A:54:LEU:HD22	1.98	0.46
1:B:76:LYS:HG3	1:B:96:THR:HG22	1.98	0.45
1:C:149:ASP:OD1	1:C:149:ASP:C	2.60	0.45
1:A:150:PRO:HB3	1:A:160:GLN:HE21	1.82	0.44
1:A:93:ARG:HB2	1:A:140:TYR:CD1	2.52	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:55:LYS:HA	1:A:55:LYS:HD2	1.85	0.44
1:A:32:GLY:HA3	1:A:113:LYS:HD3	2.00	0.43
1:A:145:ASP:OD2	1:A:164:THR:OG1	2.29	0.43
1:A:134:TYR:HB2	1:A:237:LYS:HB3	2.01	0.43
1:A:172:VAL:HG21	1:A:237:LYS:HG3	2.01	0.43
1:C:174:GLU:HB2	1:C:234:LYS:HB2	2.00	0.43
1:B:39:ARG:HH11	1:B:39:ARG:HD2	1.65	0.43
1:C:55:LYS:HA	1:C:55:LYS:HD2	1.87	0.43
1:C:115:VAL:HG13	1:C:165:MET:HE3	1.99	0.43
1:B:38:TRP:HZ2	1:B:55:LYS:O	2.03	0.42
1:C:134:TYR:HB2	1:C:237:LYS:HB3	2.02	0.42
1:A:168:TYR:CD1	1:A:204:PRO:HB3	2.54	0.41
1:B:191:GLY:O	1:B:203:LYS:HE3	2.21	0.41
1:A:147:PHE:C	1:A:149:ASP:N	2.78	0.41
1:A:173:GLU:HB3	1:A:234:LYS:O	2.20	0.41
1:A:38:TRP:CZ2	1:A:40:GLY:HA3	2.55	0.41
1:B:76:LYS:HG3	1:B:96:THR:CG2	2.50	0.41
1:C:38:TRP:C	1:C:39:ARG:HG2	2.45	0.41
1:C:101:ALA:O	1:C:102:LYS:C	2.64	0.41
1:A:172:VAL:HG12	1:A:173:GLU:H	1.86	0.40

All (1) 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)
1:C:39:ARG:NH1	1:C:184:GLU:OE2[2_555]	2.14	0.06

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	200/233 (86%)	186 (93%)	14 (7%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	191/233 (82%)	182 (95%)	8 (4%)	1 (0%)	24	54
1	C	179/233 (77%)	172 (96%)	7 (4%)	0	100	100
All	All	570/699 (82%)	540 (95%)	29 (5%)	1 (0%)	43	72

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	148	HIS

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	174/199 (87%)	168 (97%)	6 (3%)	32	66
1	B	168/199 (84%)	157 (94%)	11 (6%)	15	44
1	C	157/199 (79%)	151 (96%)	6 (4%)	29	64
All	All	499/597 (84%)	476 (95%)	23 (5%)	24	57

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	36	GLU
1	A	39	ARG
1	A	95	SER
1	A	105	ASP
1	A	166	LEU
1	A	233	LEU
1	B	33	GLU
1	B	37	GLU
1	B	75	VAL
1	B	76	LYS
1	B	77	SER
1	B	95	SER
1	B	165	MET

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Mol	Chain	Res	Type
1	B	166	LEU
1	B	174	GLU
1	B	188	THR
1	B	190	ASP
1	C	105	ASP
1	C	135	HIS
1	C	165	MET
1	C	166	LEU
1	C	190	ASP
1	C	233	LEU

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	227	HIS
1	B	117	GLN
1	B	143	HIS
1	B	160	GLN
1	B	227	HIS

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 2 ligands modelled in this entry, 2 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

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, 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	206/233 (88%)	0.31	8 (3%) 43 35	33, 38, 48, 61	0
1	B	199/233 (85%)	0.20	10 (5%) 34 27	33, 38, 52, 76	0
1	C	187/233 (80%)	0.80	20 (10%) 11 9	36, 38, 41, 63	0
All	All	592/699 (84%)	0.43	38 (6%) 25 20	33, 38, 48, 76	0

All (38) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	140	TYR	4.9
1	C	32	GLY	3.8
1	B	148	HIS	3.4
1	C	185	GLN	3.4
1	C	249	ILE	3.4
1	B	75	VAL	3.3
1	A	148	HIS	3.2
1	B	77	SER	3.0
1	A	250	GLY	2.9
1	B	142	PRO	2.9
1	C	173	GLU	2.9
1	C	29	VAL	2.8
1	A	251	GLY	2.8
1	C	147	PHE	2.8
1	A	185	GLN	2.7
1	C	155	PRO	2.7
1	B	144	TYR	2.6
1	C	68	GLU	2.5
1	C	194	GLU	2.5
1	C	184	GLU	2.5
1	A	157	HIS	2.4
1	A	189	GLY	2.4
1	B	157	HIS	2.4

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Mol	Chain	Res	Type	RSRZ
1	C	122	PRO	2.3
1	C	135	HIS	2.3
1	C	234	LYS	2.2
1	C	94	THR	2.2
1	C	232	THR	2.2
1	A	34	LEU	2.2
1	B	189	GLY	2.2
1	B	147	PHE	2.1
1	C	233	LEU	2.1
1	B	145	ASP	2.1
1	C	125	ASN	2.1
1	C	248	PRO	2.1
1	A	137	GLY	2.0
1	C	174	GLU	2.0
1	C	47	TRP	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](#)

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(\AA^2)	Q<0.9
2	CL	A	1	1/1	0.92	0.20	59,59,59,59	0
2	CL	C	2	1/1	0.93	0.09	60,60,60,60	0

6.5 Other polymers [i](#)

There are no such residues in this entry.