



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2026 – 11:43 PM UTC

PDB ID : 1N0L / pdb_00001n0l
Title : Crystal structure of the PapD chaperone (C-terminally 6x histidine-tagged) bound to the PapE pilus subunit (N-terminal-deleted) from uropathogenic E. coli
Authors : Sauer, F.G.; Pinkner, J.S.; Waksman, G.; Hultgren, S.J.
Deposited on : 2002-10-14
Resolution : 2.30 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : **NOT EXECUTED**
Xtrriage (Phenix) : 2.0
EDS : **NOT EXECUTED**
Buster-report : **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

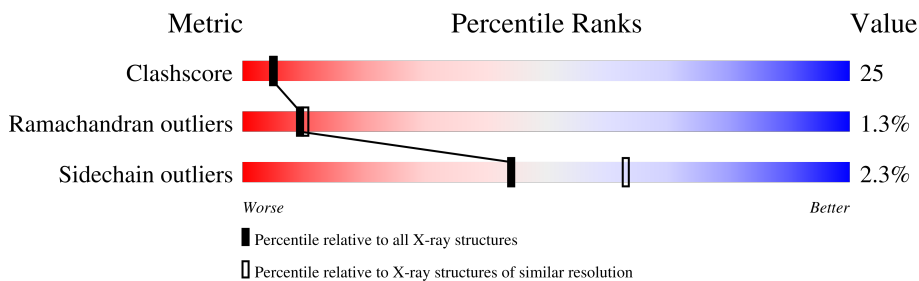
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)

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	A	224	62% 30% . .
1	C	224	69% 25% . .
2	B	138	44% 38% . 14%
2	D	138	36% 38% . 22%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 5226 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 Chaperone protein PapD.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	215	1702	1076	293	328	2	3	0	0	0
1	C	215	1696	1073	290	328	2	3	0	0	0

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	18	MSE	MET	modified residue	UNP P15319
A	66	MSE	MET	modified residue	UNP P15319
A	172	MSE	MET	modified residue	UNP P15319
A	219	HIS	-	expression tag	UNP P15319
A	220	HIS	-	expression tag	UNP P15319
A	221	HIS	-	expression tag	UNP P15319
A	222	HIS	-	expression tag	UNP P15319
A	223	HIS	-	expression tag	UNP P15319
A	224	HIS	-	expression tag	UNP P15319
C	18	MSE	MET	modified residue	UNP P15319
C	66	MSE	MET	modified residue	UNP P15319
C	172	MSE	MET	modified residue	UNP P15319
C	219	HIS	-	expression tag	UNP P15319
C	220	HIS	-	expression tag	UNP P15319
C	221	HIS	-	expression tag	UNP P15319
C	222	HIS	-	expression tag	UNP P15319
C	223	HIS	-	expression tag	UNP P15319
C	224	HIS	-	expression tag	UNP P15319

- Molecule 2 is a protein called mature Fimbrial protein PapE.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
2	B	118	877	550	146	177	2	2	0	0	0

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	N	O	S				Se
2	D	107	787	499	129	155	2	2	0	0	0

There are 28 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	?	-	ASP	deletion	UNP P08407
B	?	-	ASN	deletion	UNP P08407
B	?	-	LEU	deletion	UNP P08407
B	?	-	THR	deletion	UNP P08407
B	?	-	PHE	deletion	UNP P08407
B	?	-	ARG	deletion	UNP P08407
B	?	-	GLY	deletion	UNP P08407
B	?	-	LYS	deletion	UNP P08407
B	?	-	LEU	deletion	UNP P08407
B	?	-	ILE	deletion	UNP P08407
B	?	-	ILE	deletion	UNP P08407
B	46	MSE	MET	modified residue	UNP P08407
B	55	MSE	MET	modified residue	UNP P08407
B	130	MSE	MET	modified residue	UNP P08407
D	?	-	ASP	deletion	UNP P08407
D	?	-	ASN	deletion	UNP P08407
D	?	-	LEU	deletion	UNP P08407
D	?	-	THR	deletion	UNP P08407
D	?	-	PHE	deletion	UNP P08407
D	?	-	ARG	deletion	UNP P08407
D	?	-	GLY	deletion	UNP P08407
D	?	-	LYS	deletion	UNP P08407
D	?	-	LEU	deletion	UNP P08407
D	?	-	ILE	deletion	UNP P08407
D	?	-	ILE	deletion	UNP P08407
D	46	MSE	MET	modified residue	UNP P08407
D	55	MSE	MET	modified residue	UNP P08407
D	130	MSE	MET	modified residue	UNP P08407

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	54	Total	O	0	0
			54	54		
3	B	21	Total	O	0	0
			21	21		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	C	73	Total 73	O 73	0	0
3	D	16	Total 16	O 16	0	0

V1	P13	T16	V17	S18	M19	T20	T21	V22	D23	W24	GLN	ASP	VAL	GLU	ILE	GLN	THR	LEU	SER	GLN	ASN	GLY	ASN	HIS	E39	K40	T43	V44	M46	R47	C48	P49	L52	T60	Y65	N66	N67	V71	Q72	ASN	THR	SER	ASN	THR	SER	SER	ASP	G81	L82	L83	V84	Y85
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L86	Y87	N88	S89	N90	A91	G92	N93	I94	G95	T96	A97	I98	P106	G107	K108	I109	A114	I118	S119	L120	H121	A122	K123	L124	G125	Y126	K127	GLY	ASN	MSE	GLN	ASN	LEU	ILE	ALA	GLY	P137	F138	T143	L144	Y148	S149
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4 Data and refinement statistics

EDS was not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	56.07Å 56.86Å 60.93Å 108.57° 89.26° 104.14°	Depositor
Resolution (Å)	24.73 – 2.30	Depositor
% Data completeness (in resolution range)	90.9 (24.73-2.30)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.04	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.88 (at 2.31Å)	Xtrriage
Refinement program	CNS	Depositor
R, R_{free}	0.226 , 0.279	Depositor
Wilson B-factor (Å ²)	35.1	Xtrriage
Anisotropy	0.151	Xtrriage
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	5226	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.46% 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](#)

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	0.42	0/1734	0.91	5/2349 (0.2%)
1	C	0.42	0/1728	0.88	2/2342 (0.1%)
2	B	0.37	0/889	0.82	3/1208 (0.2%)
2	D	0.35	0/797	0.83	3/1083 (0.3%)
All	All	0.40	0/5148	0.87	13/6982 (0.2%)

There are no bond length outliers.

The worst 5 of 13 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	48	CYS	N-CA-C	6.19	120.23	110.58
1	C	102	VAL	N-CA-C	6.01	118.55	108.81
2	B	23	ASP	N-CA-C	5.82	119.15	110.14
2	D	89	SER	N-CA-C	-5.68	106.95	112.97
1	A	199	GLY	N-CA-C	-5.47	105.54	112.54

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	1702	0	1711	64	0
1	C	1696	0	1700	72	0
2	B	877	0	852	65	0
2	D	787	0	780	63	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	54	0	0	3	0
3	B	21	0	0	3	0
3	C	73	0	0	3	0
3	D	16	0	0	1	0
All	All	5226	0	5043	252	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 25.

The worst 5 of 252 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:215:LYS:H	1:A:215:LYS:HD2	1.17	1.04
1:A:32:LEU:HB2	1:A:93:ILE:HB	1.38	1.00
1:A:89:ASN:HD21	1:A:110:LYS:HE2	1.27	0.99
1:C:44:LYS:HE2	1:C:46:ILE:HD11	1.44	0.97
2:B:71:VAL:HG12	2:B:72:GLN:H	1.31	0.95

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	213/224 (95%)	203 (95%)	10 (5%)	0	100	100
1	C	213/224 (95%)	201 (94%)	12 (6%)	0	100	100
2	B	110/138 (80%)	95 (86%)	12 (11%)	3 (3%)	4	3
2	D	99/138 (72%)	89 (90%)	5 (5%)	5 (5%)	1	1
All	All	635/724 (88%)	588 (93%)	39 (6%)	8 (1%)	9	10

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	55	MSE
2	D	94	ILE
2	D	40	LYS
2	D	90	ASN
2	D	91	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	191/197 (97%)	185 (97%)	6 (3%)	35	52
1	C	190/197 (96%)	184 (97%)	6 (3%)	34	51
2	B	97/113 (86%)	97 (100%)	0	100	100
2	D	86/113 (76%)	85 (99%)	1 (1%)	63	79
All	All	564/620 (91%)	551 (98%)	13 (2%)	44	63

5 of 13 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	53	THR
1	C	96	ARG
2	D	144	LEU
1	C	171	VAL
1	C	215	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 25 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	34	GLN
1	C	101	ASN
2	D	88	ASN
1	C	89	ASN
1	C	108	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](#)

Mogul was not executed - this section is therefore empty.

5.5 Carbohydrates [i](#)

Mogul was not executed - this section is therefore empty.

5.6 Ligand geometry [i](#)

Mogul was not executed - this section is therefore empty.

5.7 Other polymers [i](#)

Mogul was not executed - this section is therefore empty.

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.