



wwPDB EM Validation Summary Report ⓘ

Dec 28, 2025 – 12:23 AM JST

PDB ID : 9LKY / pdb_00009lky
EMDB ID : EMD-63188
Title : Dimer of CRL2-FEM1B bound with PLD6
Authors : Zhao, S.; Xu, C.
Deposited on : 2025-01-17
Resolution : 3.93 Å(reported)

This is a wwPDB EM 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/EMValidationReportHelp>

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:

EMDB validation analysis : **FAILED**
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
EM percentile statistics : **NOT EXECUTED**
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.47

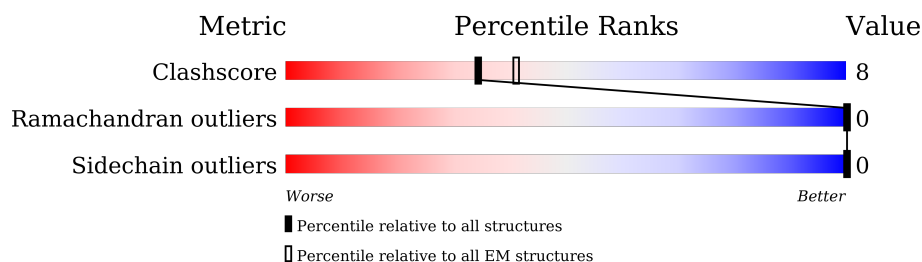
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.93 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	K	204	8% . 90%
2	A	764	75% 20% 5%
2	B	764	77% 18% 5%
3	C	96	80% 20%
3	G	96	83% 17%
4	E	96	70% 20% 10%
4	I	96	68% 17% 16%
5	F	627	80% 20%
5	J	627	79% 21%

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Mol	Chain	Length	Quality of chain
6	D	118	 56% 25% 19%
6	H	118	 57% 25% 19%

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 26308 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Mitochondrial cardiolipin hydrolase.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	K	21	Total	C	N	O	S	0	0
			157	102	28	26	1		

- Molecule 2 is a protein called Cullin-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	A	726	Total	C	N	O	S	0	0
			5953	3783	1011	1115	44		
2	B	725	Total	C	N	O	S	0	0
			5947	3781	1009	1113	44		

There are 42 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	SER	-	expression tag	UNP Q13617
A	-18	ALA	-	expression tag	UNP Q13617
A	-17	SER	-	expression tag	UNP Q13617
A	-16	TRP	-	expression tag	UNP Q13617
A	-15	SER	-	expression tag	UNP Q13617
A	-14	HIS	-	expression tag	UNP Q13617
A	-13	PRO	-	expression tag	UNP Q13617
A	-12	GLN	-	expression tag	UNP Q13617
A	-11	PHE	-	expression tag	UNP Q13617
A	-10	GLU	-	expression tag	UNP Q13617
A	-9	LYS	-	expression tag	UNP Q13617
A	-8	GLY	-	expression tag	UNP Q13617
A	-7	GLY	-	expression tag	UNP Q13617
A	-6	GLY	-	expression tag	UNP Q13617
A	-5	SER	-	expression tag	UNP Q13617
A	-4	GLY	-	expression tag	UNP Q13617
A	-3	GLY	-	expression tag	UNP Q13617
A	-2	GLY	-	expression tag	UNP Q13617
A	-1	SER	-	expression tag	UNP Q13617

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Chain	Residue	Modelled	Actual	Comment	Reference
A	0	GLY	-	expression tag	UNP Q13617
A	1	THR	-	expression tag	UNP Q13617
B	-19	SER	-	expression tag	UNP Q13617
B	-18	ALA	-	expression tag	UNP Q13617
B	-17	SER	-	expression tag	UNP Q13617
B	-16	TRP	-	expression tag	UNP Q13617
B	-15	SER	-	expression tag	UNP Q13617
B	-14	HIS	-	expression tag	UNP Q13617
B	-13	PRO	-	expression tag	UNP Q13617
B	-12	GLN	-	expression tag	UNP Q13617
B	-11	PHE	-	expression tag	UNP Q13617
B	-10	GLU	-	expression tag	UNP Q13617
B	-9	LYS	-	expression tag	UNP Q13617
B	-8	GLY	-	expression tag	UNP Q13617
B	-7	GLY	-	expression tag	UNP Q13617
B	-6	GLY	-	expression tag	UNP Q13617
B	-5	SER	-	expression tag	UNP Q13617
B	-4	GLY	-	expression tag	UNP Q13617
B	-3	GLY	-	expression tag	UNP Q13617
B	-2	GLY	-	expression tag	UNP Q13617
B	-1	SER	-	expression tag	UNP Q13617
B	0	GLY	-	expression tag	UNP Q13617
B	1	THR	-	expression tag	UNP Q13617

- Molecule 3 is a protein called Elongin-C.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	96	Total	C	N	O	S	0	0
			760	487	122	145	6		
3	G	96	Total	C	N	O	S	0	0
			760	487	122	145	6		

- Molecule 4 is a protein called E3 ubiquitin-protein ligase RBX1, N-terminally processed.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	E	86	Total	C	N	O	S	0	0
			703	445	128	121	9		
4	I	81	Total	C	N	O	S	0	0
			657	415	120	113	9		

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	13	SER	-	expression tag	UNP P62877
E	14	HIS	-	expression tag	UNP P62877
E	15	MET	-	expression tag	UNP P62877
I	13	SER	-	expression tag	UNP P62877
I	14	HIS	-	expression tag	UNP P62877
I	15	MET	-	expression tag	UNP P62877

- Molecule 5 is a protein called Protein fem-1 homolog B.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	F	627	Total	C	N	O	S	0	0
			4932	3092	882	929	29		
5	J	627	Total	C	N	O	S	0	0
			4915	3082	877	927	29		

- Molecule 6 is a protein called Elongin-B.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	H	96	Total	C	N	O	S	0	0
			759	483	129	144	3		
6	D	96	Total	C	N	O	S	0	0
			759	483	129	144	3		

- Molecule 7 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
7	E	3	Total	Zn	0
			3	3	
7	I	3	Total	Zn	0
			3	3	

L618	L443	E214	W91	SER
N624	L447	Y218	Y100	ALA
H625	S448			TPP
H626	E454	Q221	Y105	SER
S627		L226	R106	HIS
E628	F469		L108	PHO
K629		S230		GLN
	R475		Q111	PHE
S636	M480	V239		GLU
S637		E246	R115	LYS
P638	N487		ASN	GLY
K650	I501	L254	LYS	GLY
K652		H255	LEU	SER
H653	S506	P256	THR	GLY
T654	F507	Y259	GLU	GLY
K659	Q508		ALA	SER
D660	I509	M270	ASP	GLY
T661	Y510		LEU	SER
	V511	L285	GLN	GLY
R676	A516	I286	TTR	T1
		R287	GLY	P5
T684	I529	D293	VAL	F10
H685	P530		GLY	W14
R686		H293	ASP	
I687	L533	R302	MET	T20
M688	E534		ASN	
	K535	P309	GLU	A23
R691	S536	I312	P135	E28
	V537		L136	
L694		H318	M137	R32
	S549	I319		
E702		H320	E141	W35
Q706	E563	D321	W147	R38
	V564		R148	F39
R710	K565	R325	M151	
	K571	A326	V152	V47
I718	P572	T327		A48
K719	K719		L163	Y49
K720	V574	L330		P50
	A575	F350	K168	
E732	M576			R56
R733	V577	N559	R171	L57
	T578			Y58
Y741	T579	L398	I185	T59
S742	Y580	L399	R186	E60
Y743		K400	S187	
V744	L585			F64
	Y596	L415	K201	N67
	K612	I425	Q204	
	T613	D426	E205	V76
	T614	D427		
	K615	P442	E208	V63

H17	K20	L21	L22	E28	F29	G48	P49	G50	E59	F62	I65	H68	V69	L70	V73	Y76	Y79	N85	P91	L104	N108	G112
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Category	Count
M17	10
K20	10
L21	10
I22	10
S23	10
S24	10
E28	10
H35	10
A36	10
L37	10
T38	10
S39	10
G48	10
Q51	10
N61	10
Y79	10
K60	10
V81	10
R82	10
Y83	10
P91	10
L110	10
D111	10
C112	10

SER	HIS	MET	GLY	ALA	GLY	LYS	LVS	R21	K26	A31	C53	Q57	A58	N59	S62	A63	T64	E67	C68	H62	C63	I64	W67	R91	Q92	V93	C94	P95	R99	E100	W101	Q104	K105	I106	GLY	H15
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SER	HTS	MET	GLY	ALA	GLY	LYS	LYS	ARG	PHE	GLU	V24	K25	K26	W27		A31	L32		D40		A58		S62	A63		V70		H77	A78	F79		I84		W87		T90		V93		D97		Q104		TTR	LYR	GLY	GLY	HTS
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Chain F: 80% 20%

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	97465	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI MORGAGNI	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	56	Depositor
Minimum defocus (nm)	1800	Depositor
Maximum defocus (nm)	2900	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor

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

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	K	0.21	0/164	0.49	0/222
2	A	0.18	0/6069	0.34	0/8174
2	B	0.18	0/6063	0.35	0/8166
3	C	0.21	0/777	0.40	0/1050
3	G	0.21	0/777	0.40	0/1050
4	E	0.20	0/723	0.32	0/983
4	I	0.14	0/676	0.36	0/922
5	F	0.14	0/5018	0.33	0/6803
5	J	0.16	0/5001	0.34	0/6784
6	D	0.12	0/774	0.33	0/1045
6	H	0.13	0/774	0.34	0/1045
All	All	0.17	0/26816	0.34	0/36244

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 [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	K	157	0	152	5	0
2	A	5953	0	5951	96	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	5947	0	5952	86	0
3	C	760	0	749	18	0
3	G	760	0	749	13	0
4	E	703	0	652	12	0
4	I	657	0	609	14	0
5	F	4932	0	4912	79	0
5	J	4915	0	4864	84	0
6	D	759	0	761	21	0
6	H	759	0	761	20	0
7	E	3	0	0	0	0
7	I	3	0	0	0	0
All	All	26308	0	26112	416	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.

The worst 5 of 416 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)
2:B:20:THR:HG21	2:B:38:ARG:HG2	1.73	0.70
2:B:285:ILE:HD11	2:B:293:ASP:HB3	1.73	0.69
5:F:48:THR:HG22	5:F:50:LEU:H	1.59	0.66
6:D:31:VAL:O	6:D:35:LEU:HB2	1.95	0.66
2:A:425:ILE:HG22	2:A:427:ASP:H	1.60	0.66

There are no symmetry-related clashes.

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 PDB entries followed by that with respect to all EM entries.

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	K	19/204 (9%)	15 (79%)	4 (21%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	A	722/764 (94%)	691 (96%)	31 (4%)	0	100	100
2	B	721/764 (94%)	684 (95%)	37 (5%)	0	100	100
3	C	94/96 (98%)	84 (89%)	10 (11%)	0	100	100
3	G	94/96 (98%)	85 (90%)	9 (10%)	0	100	100
4	E	84/96 (88%)	82 (98%)	2 (2%)	0	100	100
4	I	79/96 (82%)	70 (89%)	9 (11%)	0	100	100
5	F	625/627 (100%)	588 (94%)	37 (6%)	0	100	100
5	J	625/627 (100%)	590 (94%)	35 (6%)	0	100	100
6	D	92/118 (78%)	90 (98%)	2 (2%)	0	100	100
6	H	92/118 (78%)	86 (94%)	6 (6%)	0	100	100
All	All	3247/3606 (90%)	3065 (94%)	182 (6%)	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 PDB entries followed by that with respect to all EM entries.

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	K	17/172 (10%)	17 (100%)	0	100	100
2	A	666/693 (96%)	666 (100%)	0	100	100
2	B	666/693 (96%)	666 (100%)	0	100	100
3	C	85/85 (100%)	85 (100%)	0	100	100
3	G	85/85 (100%)	85 (100%)	0	100	100
4	E	74/82 (90%)	74 (100%)	0	100	100
4	I	70/82 (85%)	70 (100%)	0	100	100
5	F	536/536 (100%)	536 (100%)	0	100	100
5	J	529/536 (99%)	529 (100%)	0	100	100
6	D	84/103 (82%)	84 (100%)	0	100	100
6	H	84/103 (82%)	84 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
All	All	2896/3170 (91%)	2896 (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. 5 of 45 such sidechains are listed below:

Mol	Chain	Res	Type
5	F	458	GLN
6	H	42	GLN
5	F	511	ASN
5	J	369	HIS
2	B	67	ASN

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 6 ligands modelled in this entry, 6 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.