



wwPDB X-ray Structure Validation Summary Report ⓘ

Apr 25, 2026 – 04:56 PM EDT

PDB ID : 5EN5 / pdb_00005en5
Title : Apo structure of bacterial efflux pump.
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Deposited on : 2015-11-09
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
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

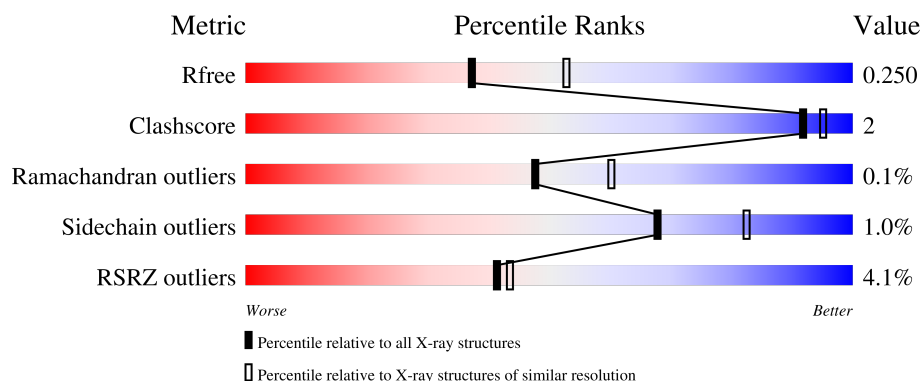
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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))
R_{free}	180053	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (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 $\leq 5\%$. 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	609	4% 91% 5%
1	B	609	2% 89% 6% 5%
1	C	609	5% 91% 5%
2	D	169	4% 91% 5%
2	E	169	5% 86% 6% 8%

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Mol	Chain	Length	Quality of chain
2	F	169	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 17497 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 Multidrug efflux pump subunit AcrB, Multidrug efflux pump subunit AcrB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	580	Total	C	N	O	S	0	0	0
			4417	2773	748	874	22			
1	B	578	Total	C	N	O	S	0	0	0
			4405	2766	746	871	22			
1	C	584	Total	C	N	O	S	0	0	0
			4441	2789	752	878	22			

There are 27 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	552	GLY	-	linker	UNP P31224
A	553	GLY	-	linker	UNP P31224
A	554	SER	-	linker	UNP P31224
A	555	GLY	-	linker	UNP P31224
A	556	GLY	-	linker	UNP P31224
A	557	SER	-	linker	UNP P31224
A	558	GLY	-	linker	UNP P31224
A	559	GLY	-	linker	UNP P31224
A	560	SER	-	linker	UNP P31224
B	552	GLY	-	linker	UNP P31224
B	553	GLY	-	linker	UNP P31224
B	554	SER	-	linker	UNP P31224
B	555	GLY	-	linker	UNP P31224
B	556	GLY	-	linker	UNP P31224
B	557	SER	-	linker	UNP P31224
B	558	GLY	-	linker	UNP P31224
B	559	GLY	-	linker	UNP P31224
B	560	SER	-	linker	UNP P31224
C	552	GLY	-	linker	UNP P31224
C	553	GLY	-	linker	UNP P31224
C	554	SER	-	linker	UNP P31224
C	555	GLY	-	linker	UNP P31224

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Chain	Residue	Modelled	Actual	Comment	Reference
C	556	GLY	-	linker	UNP P31224
C	557	SER	-	linker	UNP P31224
C	558	GLY	-	linker	UNP P31224
C	559	GLY	-	linker	UNP P31224
C	560	SER	-	linker	UNP P31224

- Molecule 2 is a protein called DARPin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	161	Total	C	N	O	S	0	0	0
			1227	771	221	234	1			
2	E	156	Total	C	N	O	S	0	0	0
			1177	741	206	229	1			
2	F	162	Total	C	N	O	S	0	0	0
			1237	777	224	235	1			

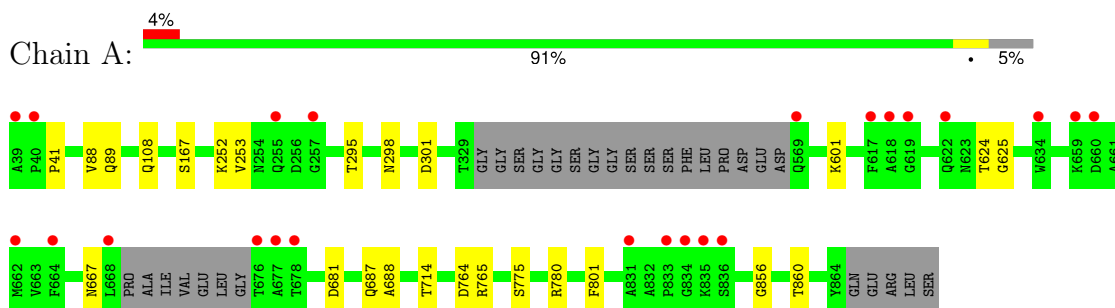
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	169	Total	O	0	0
			169	169		
3	B	193	Total	O	0	0
			193	193		
3	C	173	Total	O	0	0
			173	173		
3	D	23	Total	O	0	0
			23	23		
3	E	17	Total	O	0	0
			17	17		
3	F	18	Total	O	0	0
			18	18		

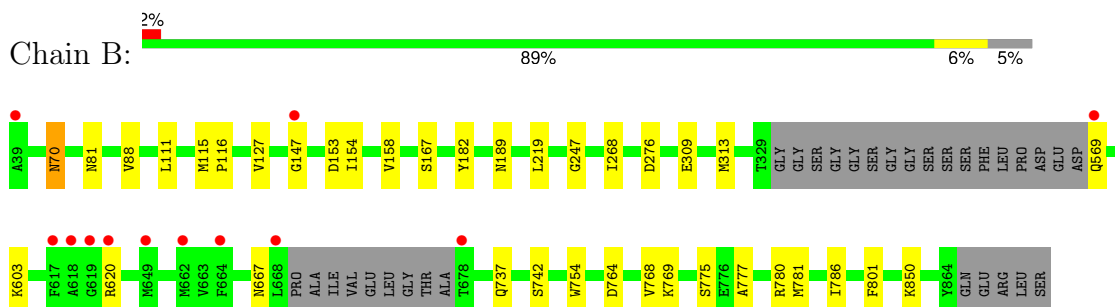
3 Residue-property plots [i](#)

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.

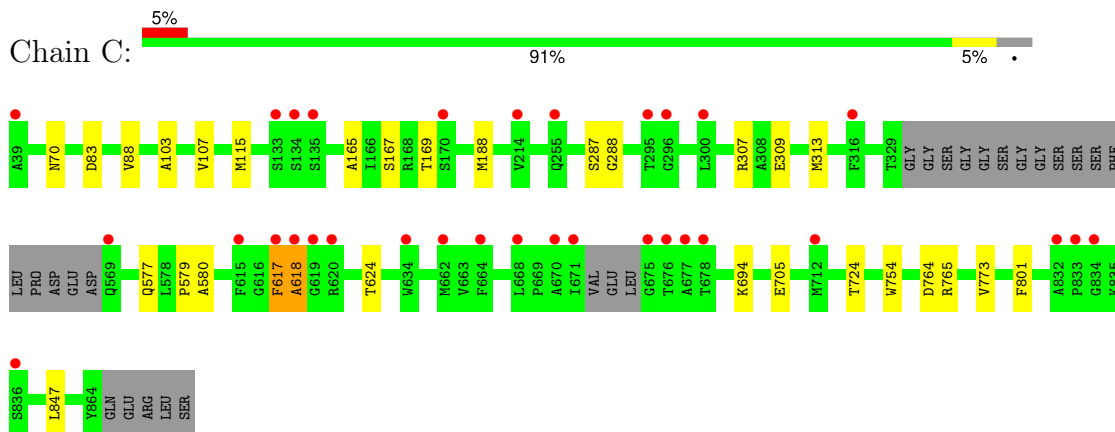
- Molecule 1: Multidrug efflux pump subunit AcrB, Multidrug efflux pump subunit AcrB



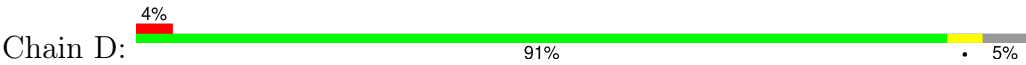
- Molecule 1: Multidrug efflux pump subunit AcrB, Multidrug efflux pump subunit AcrB



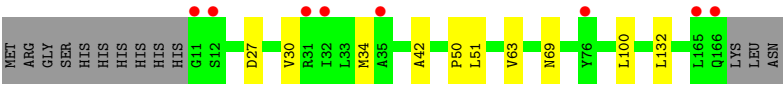
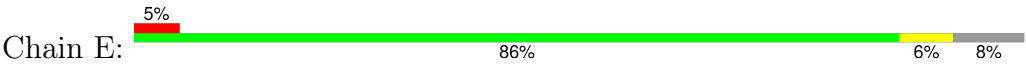
- Molecule 1: Multidrug efflux pump subunit AcrB, Multidrug efflux pump subunit AcrB



- Molecule 2: DARPin



• Molecule 2: DARPin



• Molecule 2: DARPin



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	108.34Å 145.29Å 174.54Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.30 50.00 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.7 (50.00-2.30) 99.7 (50.00-2.30)	Depositor EDS
R_{merge}	0.19	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.29 (at 2.29Å)	Xtriage
Refinement program	REFMAC 5.8.0131	Depositor
R, R_{free}	0.197 , 0.249 0.202 , 0.250	Depositor DCC
R_{free} test set	5991 reflections (4.88%)	wwPDB-VP
Wilson B-factor (Å ²)	29.7	Xtriage
Anisotropy	0.297	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 24.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	17497	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.68% 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

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	1.07	0/4492	1.04	1/6087 (0.0%)
1	B	1.08	3/4480 (0.1%)	1.07	3/6070 (0.0%)
1	C	1.06	3/4517 (0.1%)	1.05	2/6122 (0.0%)
2	D	0.99	0/1251	1.04	1/1701 (0.1%)
2	E	0.95	0/1196	1.04	0/1626
2	F	0.95	0/1262	1.02	0/1716
All	All	1.05	6/17198 (0.0%)	1.05	7/23322 (0.0%)

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	579	PRO	CA-C	5.81	1.59	1.52
1	C	167	SER	CA-C	5.79	1.60	1.52
1	B	189	ASN	C-O	-5.67	1.18	1.24
1	B	81	ASN	C-O	-5.47	1.17	1.24
1	B	768	VAL	C-O	-5.41	1.18	1.24

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	603	LYS	CB-CA-C	-6.83	99.40	110.74
2	D	10	HIS	N-CA-C	6.77	120.05	109.96
1	C	83	ASP	N-CA-C	6.14	118.74	109.41
1	B	620	ARG	N-CA-C	5.97	118.14	108.34
1	A	601	LYS	N-CA-C	5.94	118.71	111.82

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	4417	0	4355	13	0
1	B	4405	0	4343	15	0
1	C	4441	0	4381	17	0
2	D	1227	0	1194	2	0
2	E	1177	0	1159	6	0
2	F	1237	0	1201	4	0
3	A	169	0	0	2	0
3	B	193	0	0	0	0
3	C	173	0	0	3	0
3	D	23	0	0	0	0
3	E	17	0	0	0	0
3	F	18	0	0	0	0
All	All	17497	0	16633	53	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 2.

The worst 5 of 53 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:108:GLN:OE1	3:A:901:HOH:O	2.08	0.72
2:D:34:MET:HA	2:D:34:MET:HE2	1.80	0.64
1:B:569:GLN:HG2	1:B:667:ASN:HD21	1.64	0.63
2:F:34:MET:HE2	2:F:34:MET:HA	1.80	0.63
1:C:580:ALA:HB1	1:C:724:THR:HG22	1.81	0.62

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 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	574/609 (94%)	556 (97%)	18 (3%)	0	100	100
1	B	572/609 (94%)	556 (97%)	15 (3%)	1 (0%)	43	55
1	C	578/609 (95%)	558 (96%)	19 (3%)	1 (0%)	43	55
2	D	159/169 (94%)	156 (98%)	2 (1%)	1 (1%)	21	27
2	E	154/169 (91%)	150 (97%)	4 (3%)	0	100	100
2	F	160/169 (95%)	157 (98%)	3 (2%)	0	100	100
All	All	2197/2334 (94%)	2133 (97%)	61 (3%)	3 (0%)	48	60

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	D	13	ASP
1	C	618	ALA
1	B	147	GLY

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	471/492 (96%)	467 (99%)	4 (1%)	73	86
1	B	470/492 (96%)	465 (99%)	5 (1%)	65	81
1	C	473/492 (96%)	470 (99%)	3 (1%)	78	89
2	D	125/132 (95%)	123 (98%)	2 (2%)	55	73
2	E	120/132 (91%)	119 (99%)	1 (1%)	73	86
2	F	126/132 (96%)	124 (98%)	2 (2%)	55	73
All	All	1785/1872 (95%)	1768 (99%)	17 (1%)	68	82

5 of 17 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	E	27	ASP
2	F	61	GLU
1	B	801	PHE
1	B	850	LYS
1	C	88	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 28 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	667	ASN
2	F	122	ASN
1	C	194	ASN
2	E	125	HIS
1	C	112	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](#)

There are no ligands in this entry.

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	580/609 (95%)	-0.10	23 (3%) 42 44	16, 30, 66, 102	0
1	B	578/609 (94%)	-0.24	12 (2%) 63 65	15, 28, 57, 96	0
1	C	584/609 (95%)	0.02	32 (5%) 30 32	17, 32, 71, 106	0
2	D	161/169 (95%)	0.13	6 (3%) 45 48	22, 37, 67, 106	0
2	E	156/169 (92%)	0.23	8 (5%) 33 35	24, 37, 75, 110	0
2	F	162/169 (95%)	0.53	11 (6%) 23 25	27, 43, 80, 112	0
All	All	2221/2334 (95%)	-0.02	92 (4%) 41 43	15, 32, 67, 112	0

The worst 5 of 92 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	E	11	GLY	6.5
1	B	617	PHE	5.9
1	A	668	LEU	5.8
2	D	11	GLY	5.7
1	A	676	THR	5.6

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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.