



wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 30, 2023 – 02:33 PM JST

PDB ID : 5B58
Title : Inward-facing conformation of ABC heme importer BhuUV in complex with periplasmic heme binding protein BhuT from Burkholderia cenocepacia
Authors : Naoe, Y.; Nakamura, N.; Doi, A.; Shiro, Y.; Sugimoto, H.
Deposited on : 2016-04-25
Resolution : 3.21 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 : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.36
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

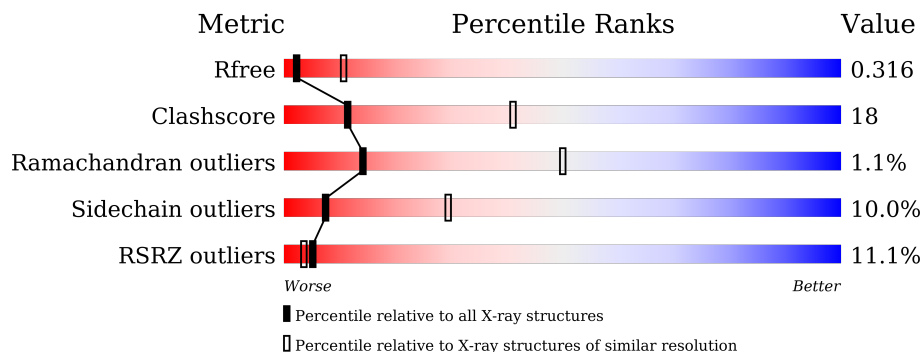
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.21 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}	130704	1335 (3.24-3.20)
Clashscore	141614	1460 (3.24-3.20)
Ramachandran outliers	138981	1437 (3.24-3.20)
Sidechain outliers	138945	1436 (3.24-3.20)
RSRZ outliers	127900	1291 (3.24-3.20)

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	385	 6% 48% 34% 14%
1	B	385	 4% 53% 29% 14%
2	C	273	 3% 51% 40% 5%
2	D	273	 3% 55% 33% 7%
3	T	271	 39% 77% 20%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 10446 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 Putative hemin ABC transport system, membrane protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	331	2326	1512	413	393	8	0	0	0
1	B	331	2326	1512	413	393	8	0	0	0

There are 46 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-22	MET	-	expression tag	UNP B4EKB4
A	-21	GLY	-	expression tag	UNP B4EKB4
A	-20	HIS	-	expression tag	UNP B4EKB4
A	-19	HIS	-	expression tag	UNP B4EKB4
A	-18	HIS	-	expression tag	UNP B4EKB4
A	-17	HIS	-	expression tag	UNP B4EKB4
A	-16	HIS	-	expression tag	UNP B4EKB4
A	-15	HIS	-	expression tag	UNP B4EKB4
A	-14	HIS	-	expression tag	UNP B4EKB4
A	-13	HIS	-	expression tag	UNP B4EKB4
A	-12	HIS	-	expression tag	UNP B4EKB4
A	-11	HIS	-	expression tag	UNP B4EKB4
A	-10	SER	-	expression tag	UNP B4EKB4
A	-9	SER	-	expression tag	UNP B4EKB4
A	-8	GLY	-	expression tag	UNP B4EKB4
A	-7	HIS	-	expression tag	UNP B4EKB4
A	-6	ILE	-	expression tag	UNP B4EKB4
A	-5	ASP	-	expression tag	UNP B4EKB4
A	-4	ASP	-	expression tag	UNP B4EKB4
A	-3	ASP	-	expression tag	UNP B4EKB4
A	-2	ASP	-	expression tag	UNP B4EKB4
A	-1	LYS	-	expression tag	UNP B4EKB4
A	0	HIS	-	expression tag	UNP B4EKB4
B	-22	MET	-	expression tag	UNP B4EKB4
B	-21	GLY	-	expression tag	UNP B4EKB4

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-20	HIS	-	expression tag	UNP B4EKB4
B	-19	HIS	-	expression tag	UNP B4EKB4
B	-18	HIS	-	expression tag	UNP B4EKB4
B	-17	HIS	-	expression tag	UNP B4EKB4
B	-16	HIS	-	expression tag	UNP B4EKB4
B	-15	HIS	-	expression tag	UNP B4EKB4
B	-14	HIS	-	expression tag	UNP B4EKB4
B	-13	HIS	-	expression tag	UNP B4EKB4
B	-12	HIS	-	expression tag	UNP B4EKB4
B	-11	HIS	-	expression tag	UNP B4EKB4
B	-10	SER	-	expression tag	UNP B4EKB4
B	-9	SER	-	expression tag	UNP B4EKB4
B	-8	GLY	-	expression tag	UNP B4EKB4
B	-7	HIS	-	expression tag	UNP B4EKB4
B	-6	ILE	-	expression tag	UNP B4EKB4
B	-5	ASP	-	expression tag	UNP B4EKB4
B	-4	ASP	-	expression tag	UNP B4EKB4
B	-3	ASP	-	expression tag	UNP B4EKB4
B	-2	ASP	-	expression tag	UNP B4EKB4
B	-1	LYS	-	expression tag	UNP B4EKB4
B	0	HIS	-	expression tag	UNP B4EKB4

- Molecule 2 is a protein called Hemin import ATP-binding protein HmuV.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	C	258	Total 1951	C 1228	N 370	O 346	S 7	0	0	0
2	D	253	Total 1907	C 1203	N 357	O 340	S 7	0	0	0

- Molecule 3 is a protein called Putative hemin transport system, substrate-binding protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	T	265	Total 1936	C 1216	N 361	O 356	S 3	0	0	0

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
T	35	GLY	-	expression tag	UNP B4EKB3
T	36	PRO	-	expression tag	UNP B4EKB3
T	37	LEU	-	expression tag	UNP B4EKB3

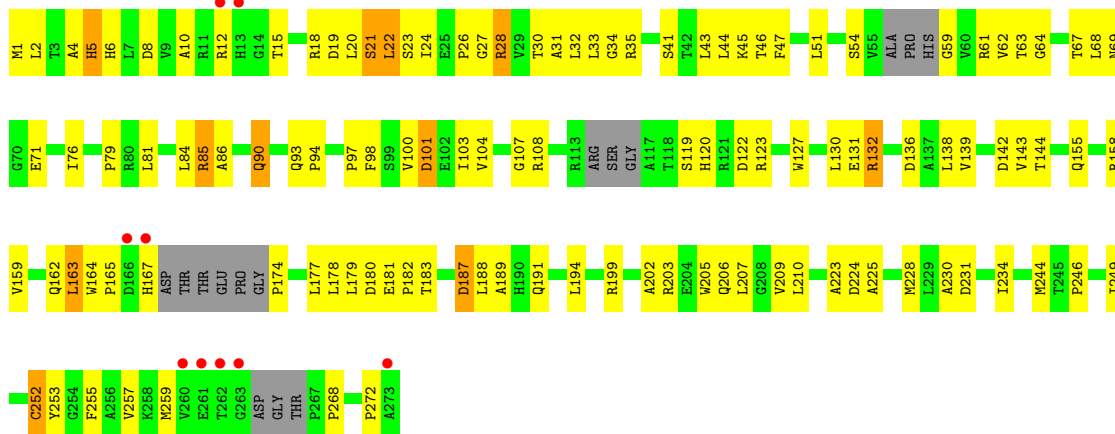
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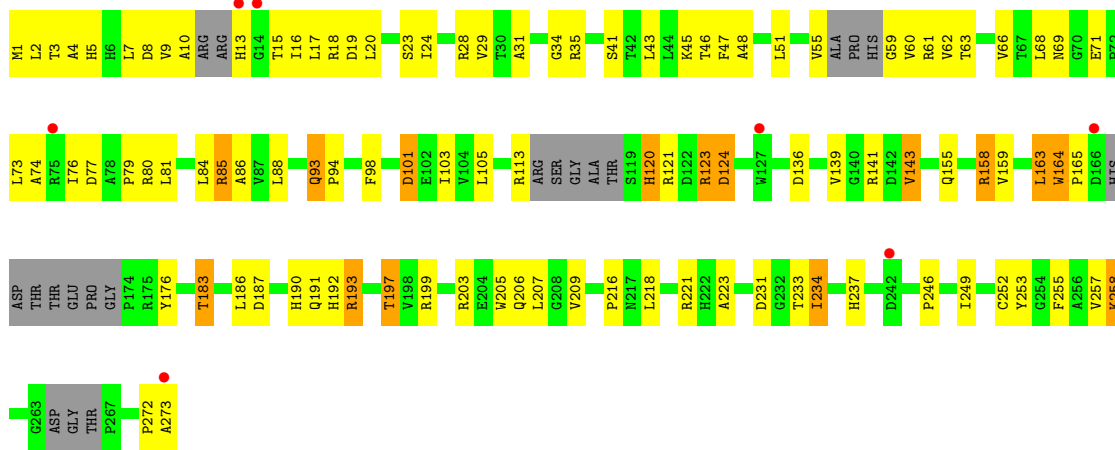
Chain	Residue	Modelled	Actual	Comment	Reference
T	38	GLY	-	expression tag	UNP B4EKB3
T	39	SER	-	expression tag	UNP B4EKB3



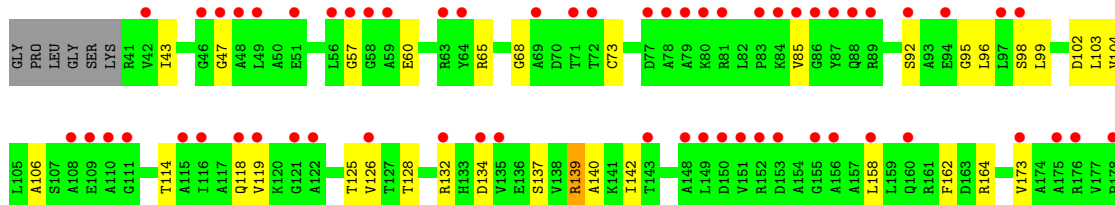
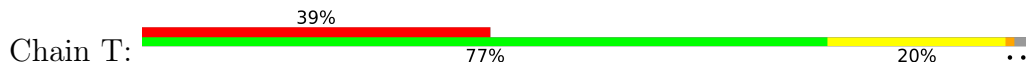
- Molecule 2: Hemin import ATP-binding protein HmuV

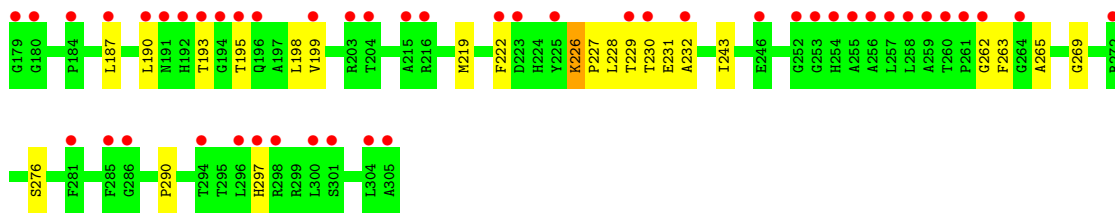


- Molecule 2: Hemin import ATP-binding protein HmuV



- Molecule 3: Putative hemin transport system, substrate-binding protein





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	69.02Å 99.75Å 253.50Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	32.61 – 3.21 32.61 – 3.21	Depositor EDS
% Data completeness (in resolution range)	76.1 (32.61-3.21) 76.1 (32.61-3.21)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.34 (at 3.18Å)	Xtrriage
Refinement program	PHENIX (1.10.1_2155: ???)	Depositor
R, R_{free}	0.269 , 0.309 0.272 , 0.316	Depositor DCC
R_{free} test set	1066 reflections (4.75%)	wwPDB-VP
Wilson B-factor (Å ²)	61.8	Xtrriage
Anisotropy	0.160	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.19 , 30.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.36$, $\langle L^2 \rangle = 0.19$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.81	EDS
Total number of atoms	10446	wwPDB-VP
Average B, all atoms (Å ²)	75.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.96% 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	0.39	0/2363	0.64	2/3232 (0.1%)
1	B	0.42	0/2363	0.69	2/3232 (0.1%)
2	C	0.44	0/1988	0.65	0/2704
2	D	0.43	1/1942 (0.1%)	0.69	0/2641
3	T	0.26	0/1970	0.46	0/2684
All	All	0.40	1/10626 (0.0%)	0.63	4/14493 (0.0%)

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	2

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	143	VAL	CB-CG1	-5.36	1.41	1.52

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	204	ARG	NE-CZ-NH2	-5.79	117.41	120.30
1	B	248	LEU	CA-CB-CG	5.71	128.44	115.30
1	A	173	LEU	CA-CB-CG	5.67	128.34	115.30
1	A	344	LEU	CA-CB-CG	5.42	127.75	115.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	348	PHE	Peptide
1	A	52	ALA	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	2326	0	2502	106	0
1	B	2326	0	2502	111	0
2	C	1951	0	1987	86	0
2	D	1907	0	1941	71	0
3	T	1936	0	1974	49	0
All	All	10446	0	10906	378	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 18.

The worst 5 of 378 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:27:ARG:O	1:A:29:ALA:N	1.90	1.03
1:A:334:ASP:HB2	3:T:92:SER:HB2	1.42	1.00
1:B:63:ALA:HB1	1:B:74:ARG:HB2	1.51	0.91
1:B:59:GLU:HG2	1:B:72:GLN:HB3	1.52	0.89
1:B:84:ARG:HH22	1:B:215:GLY:HA2	1.38	0.89

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	327/385 (85%)	284 (87%)	37 (11%)	6 (2%)	8	39
1	B	327/385 (85%)	294 (90%)	28 (9%)	5 (2%)	10	43
2	C	248/273 (91%)	232 (94%)	14 (6%)	2 (1%)	19	57
2	D	241/273 (88%)	227 (94%)	12 (5%)	2 (1%)	19	57
3	T	263/271 (97%)	255 (97%)	7 (3%)	1 (0%)	34	69
All	All	1406/1587 (89%)	1292 (92%)	98 (7%)	16 (1%)	14	50

5 of 16 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	25	SER
1	A	28	PHE
1	A	171	LEU
1	B	357	ARG
2	D	164	TRP

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	220/259 (85%)	189 (86%)	31 (14%)	3	15
1	B	220/259 (85%)	197 (90%)	23 (10%)	7	27
2	C	198/209 (95%)	178 (90%)	20 (10%)	7	29
2	D	194/209 (93%)	169 (87%)	25 (13%)	4	19
3	T	186/190 (98%)	183 (98%)	3 (2%)	62	83
All	All	1018/1126 (90%)	916 (90%)	102 (10%)	7	29

5 of 102 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	C	21	SER

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Mol	Chain	Res	Type
2	C	207	LEU
3	T	102	ASP
2	C	28	ARG
2	C	101	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
2	C	93	GLN
2	D	192	HIS
3	T	118	GLN
3	T	192	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 monosaccharides 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	331/385 (85%)	-0.11	22 (6%) 18 11	34, 64, 170, 254	0
1	B	331/385 (85%)	-0.32	15 (4%) 33 21	13, 52, 166, 199	0
2	C	258/273 (94%)	-0.20	9 (3%) 44 29	27, 59, 124, 170	0
2	D	253/273 (92%)	-0.32	7 (2%) 53 39	13, 52, 107, 143	0
3	T	265/271 (97%)	2.06	107 (40%) 0 0	76, 108, 128, 141	265 (100%)
All	All	1438/1587 (90%)	0.19	160 (11%) 5 3	13, 67, 137, 254	265 (18%)

The worst 5 of 160 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	T	254	HIS	10.5
3	T	193	THR	10.2
3	T	215	ALA	10.2
3	T	191	ASN	9.8
2	C	166	ASP	8.9

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 monosaccharides 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.