WORLDWIDE PDB PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report (i)

May 25, 2020 – 07:26 am BST

PDB ID	:	4KJR
Title	:	Crystal structure of selenium substituted Ca2+/H+ antiporter proteinYfkE
Authors	:	Wu, M.; Tong, S.; Zheng, L.
Deposited on	:	2013-05-03
Resolution	:	3.00 Å(reported)

The following versions of software and data (see references (i)) were used in the production of this report:

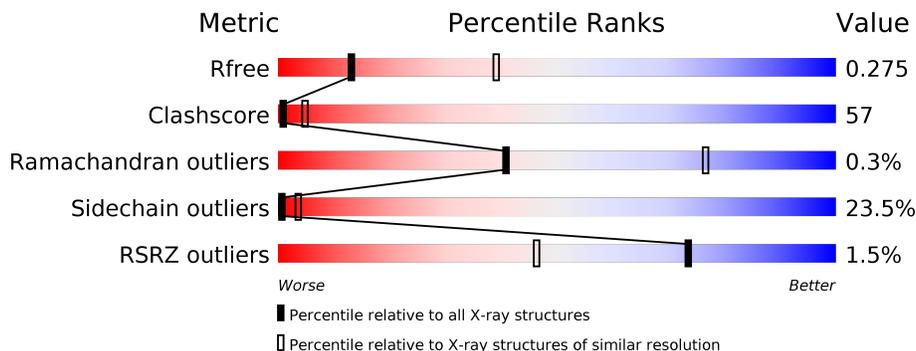|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 3.00 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	Percentile Ranks	Value
Rfree		0.275
Clashscore		57
Ramachandran outliers		0.3%
Sidechain outliers		23.5%
RSRZ outliers		1.5%

Worse ← → *Better*

■ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (3.00-3.00)

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 on 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 <=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	351	39% · 39% · 14% · 7%
1	B	351	37% · 39% · 12% · 11%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 4785 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 cation exchanger YfkE.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	325	Total 2441	C 1628	N 379	O 420	S 2	Se 12	0	0	0
1	B	311	Total 2332	C 1560	N 360	O 398	S 2	Se 12	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	77	MSE	LEU	ENGINEERED MUTATION	UNP O34840
A	116	ALA	LYS	ENGINEERED MUTATION	UNP O34840
B	77	MSE	LEU	ENGINEERED MUTATION	UNP O34840
B	116	ALA	LYS	ENGINEERED MUTATION	UNP O34840

- Molecule 2 is water.

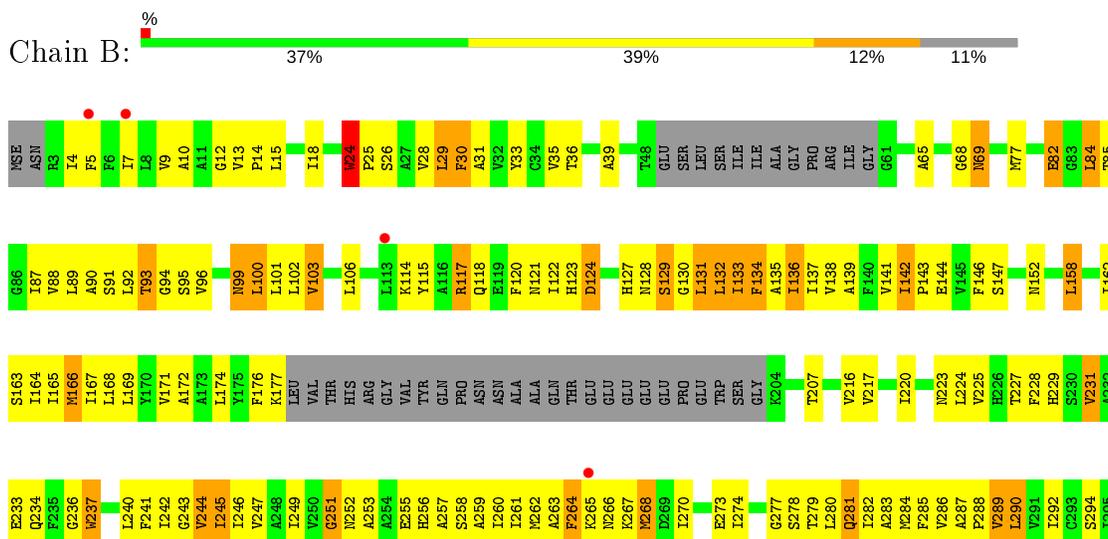| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	8	Total 8	O 8	0	0
2	B	4	Total 4	O 4	0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA and DNA 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: cation exchanger YfkE

- Molecule 1: cation exchanger YfkE

F296 F297 P298 T299 S300 M301 P302 L303 V304 F305 T306 L307 L310 V311 A312 M313 V314 S315 A316 V317 L318 L319 M320 I321 D326 G327 D328 S329 N330 W331 F332 E333 G334 A335 L338 Y341 V342 L350 L351
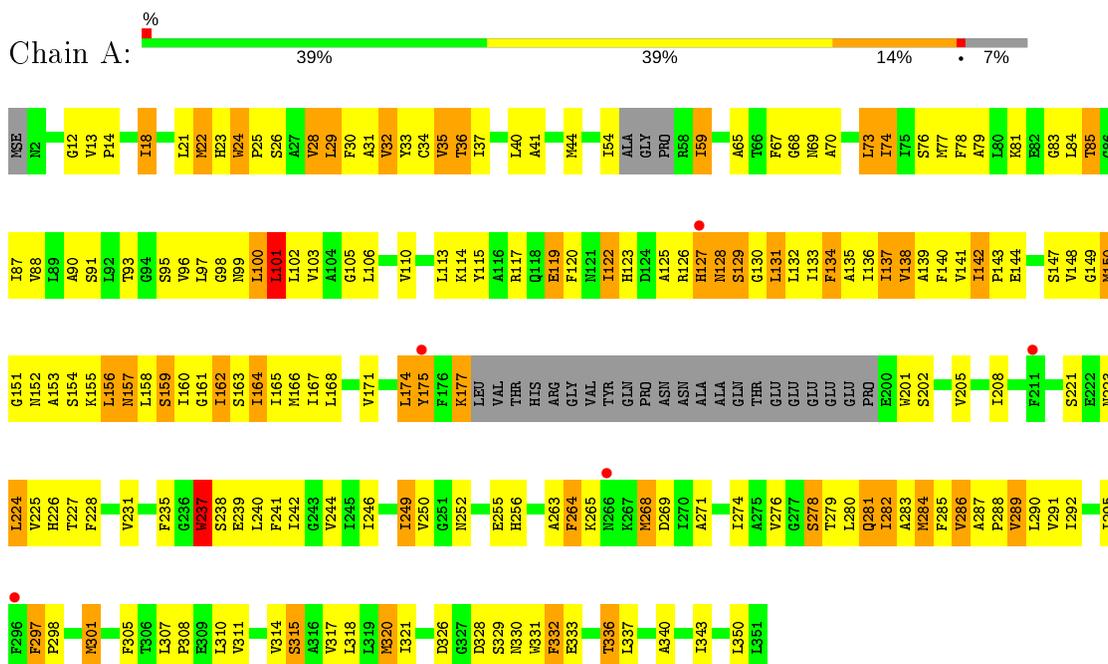
4 Data and refinement statistics (i)

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, α, β, γ	170.30Å 170.30Å 95.27Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	85.16 – 3.00 48.11 – 2.99	Depositor EDS
% Data completeness (in resolution range)	99.6 (85.16-3.00) 98.9 (48.11-2.99)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	1.96 (at 3.01Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, R_{free}	0.239 , 0.268 0.250 , 0.275	Depositor DCC
R_{free} test set	1061 reflections (5.14%)	wwPDB-VP
Wilson B-factor (Å^2)	89.6	Xtriage
Anisotropy	0.125	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.19 , 11.2	EDS
L-test for twinning[2]	$<|L|> = 0.42, <L^2> = 0.24$	Xtriage
Estimated twinning fraction	0.448 for h,-h-k,-l	Xtriage
Reported twinning fraction	0.531 for H, K, L 0.469 for K, H, -L	Depositor
Outliers	0 of 20634 reflections	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	4785	wwPDB-VP
Average B, all atoms (Å^2)	91.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.46% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.

[2]Theoretical values of $<|L|>$, $<L^2>$ 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	0.46	4/2478 (0.2%)	0.58	1/3352 (0.0%)
1	B	0.45	1/2367 (0.0%)	0.59	0/3202
All	All	0.46	5/4845 (0.1%)	0.58	1/6554 (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	1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	237	TRP	CD2-CE2	5.23	1.47	1.41
1	A	201	TRP	CD2-CE2	5.15	1.47	1.41
1	A	331	TRP	CD2-CE2	5.13	1.47	1.41
1	A	24	TRP	CD2-CE2	5.08	1.47	1.41
1	B	331	TRP	CD2-CE2	5.02	1.47	1.41

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	101	LEU	N-CA-C	-5.37	96.51	111.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	100	LEU	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	2441	0	2554	304	0
1	B	2332	0	2449	256	0
2	A	8	0	0	0	0
2	B	4	0	0	0	0
All	All	4785	0	5003	559	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 57.

The worst 5 of 559 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:78:PHE:CE2	1:A:225:VAL:HG13	1.20	1.63
1:A:30:PHE:HE1	1:A:228:PHE:CE2	1.25	1.53
1:A:30:PHE:CE1	1:A:228:PHE:CE2	1.95	1.52
1:A:30:PHE:CE1	1:A:228:PHE:HE2	1.24	1.51
1:A:78:PHE:CE2	1:A:225:VAL:CG1	1.95	1.49

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	319/351 (91%)	295 (92%)	24 (8%)	0	100	100
1	B	305/351 (87%)	286 (94%)	17 (6%)	2 (1%)	22	60

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	624/702 (89%)	581 (93%)	41 (7%)	2 (0%)	41 76

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	24	TRP
1	B	251	GLY

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	259/267 (97%)	200 (77%)	59 (23%)	1 4
1	B	247/267 (92%)	187 (76%)	60 (24%)	0 3
All	All	506/534 (95%)	387 (76%)	119 (24%)	1 3

5 of 119 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	326	ASP
1	B	77	MSE
1	B	314	VAL
1	A	332	PHE
1	B	9	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	266	ASN
1	B	69	ASN
1	B	256	HIS
1	A	256	HIS
1	B	252	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 carbohydrates 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	313/351 (89%)	-0.45	5 (1%)	72	44	50, 90, 131, 157	0
1	B	299/351 (85%)	-0.47	4 (1%)	77	51	47, 87, 123, 143	0
All	All	612/702 (87%)	-0.46	9 (1%)	73	46	47, 89, 126, 157	0

The worst 5 of 9 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	211	PHE	4.4
1	A	266	ASN	3.2
1	B	7	ILE	3.1
1	A	127	HIS	2.7
1	B	5	PHE	2.6

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 carbohydrates 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.