



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 15, 2016 – 02:30 PM EDT

PDB ID : 4ZM5  
Title : Shigella flexneri lipopolysaccharide O-antigen chain-length regulator WzzBSF  
- A107P mutant  
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Deposited on : 2015-05-02  
Resolution : 2.47 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.  
We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)  
A user guide is available at  
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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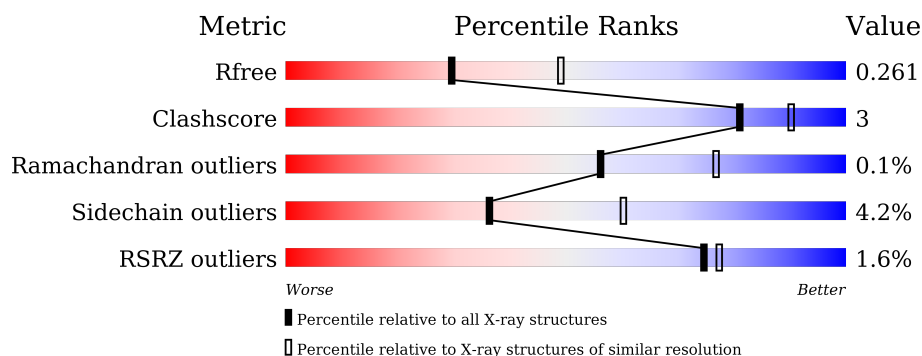
The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : unknown  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20027107  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0122  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : rb-20027107

**i**

## X-RAY DIFFRACTION

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))
$R_{free}$	91344	4309 (2.50-2.46)
Clashscore	102246	5050 (2.50-2.46)
Ramachandran outliers	100387	4961 (2.50-2.46)
Sidechain outliers	100360	4963 (2.50-2.46)
RSRZ outliers	91569	4319 (2.50-2.46)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	243	<div> <div></div> <div>85%</div> <div>8%</div> <div>5%</div> </div>
1	B	243	<div> <div></div> <div>84%</div> <div>13%</div> <div></div> </div>
1	C	243	<div> <div></div> <div>84%</div> <div>8%</div> <div>7%</div> </div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5699 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 Chain length determinant protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	230	Total	C	N	O	S	0	0	0
			1841	1153	315	369	4			
1	B	237	Total	C	N	O	S	0	0	0
			1895	1186	326	379	4			
1	C	227	Total	C	N	O	S	0	1	0
			1820	1143	315	358	4			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	SER	-	expression tag	UNP P37792
A	2	ASN	-	expression tag	UNP P37792
A	3	ALA	-	expression tag	UNP P37792
A	57	PRO	ALA	engineered mutation	UNP P37792
B	1	SER	-	expression tag	UNP P37792
B	2	ASN	-	expression tag	UNP P37792
B	3	ALA	-	expression tag	UNP P37792
B	57	PRO	ALA	engineered mutation	UNP P37792
C	1	SER	-	expression tag	UNP P37792
C	2	ASN	-	expression tag	UNP P37792
C	3	ALA	-	expression tag	UNP P37792
C	57	PRO	ALA	engineered mutation	UNP P37792

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Cl	0	0
			1	1		

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total 1	Mg 1	0	0

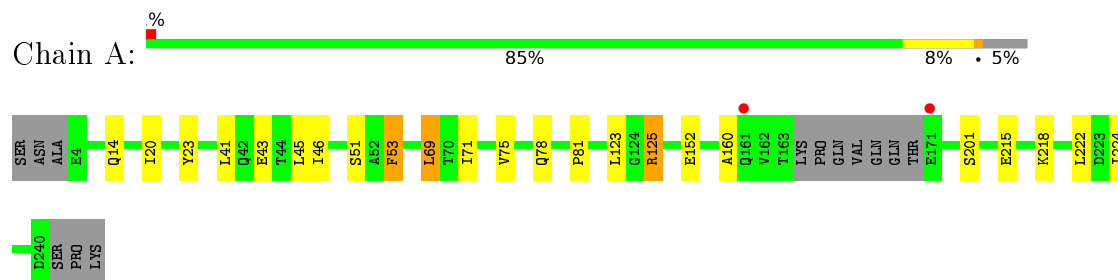
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	51	Total 51	O 51	0	0
4	B	53	Total 53	O 53	0	0
4	C	37	Total 37	O 37	0	0

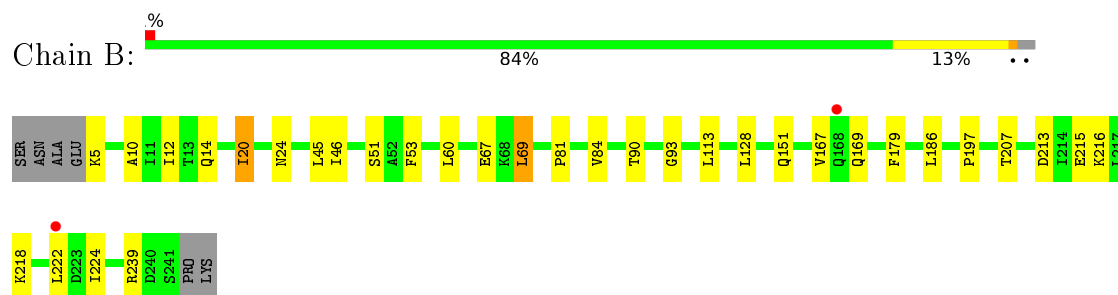
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

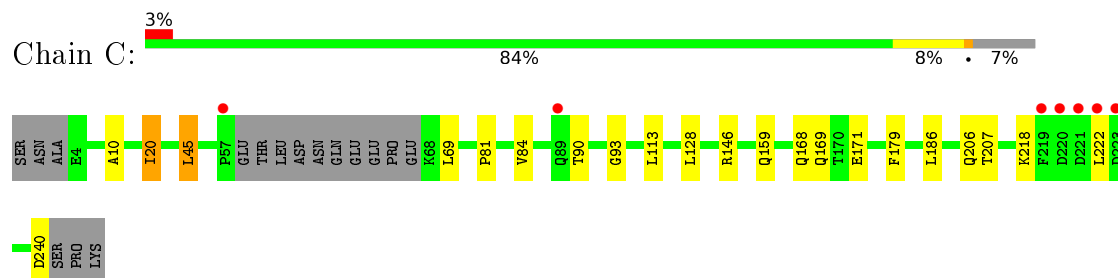
- Molecule 1: Chain length determinant protein



- Molecule 1: Chain length determinant protein



- Molecule 1: Chain length determinant protein



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	80.57Å 62.46Å 90.24Å 90.00° 94.06° 90.00°	Depositor
Resolution (Å)	32.14 – 2.47 90.01 – 2.48	Depositor EDS
% Data completeness (in resolution range)	97.7 (32.14-2.47) 97.5 (90.01-2.48)	Depositor EDS
$R_{merge}$	0.22	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.82 (at 2.48Å)	Xtriage
Refinement program	BUSTER 2.10.0	Depositor
R, $R_{free}$	0.195 , 0.242 0.209 , 0.261	Depositor DCC
$R_{free}$ test set	1572 reflections (5.30%)	DCC
Wilson B-factor (Å <sup>2</sup> )	34.0	Xtriage
Anisotropy	0.437	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 35.9	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Outliers	0 of 31224 reflections	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	5699	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.83% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MG, CL

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	0.50	0/1867	0.64	0/2529
1	B	0.48	0/1923	0.64	0/2607
1	C	0.48	0/1849	0.62	0/2504
All	All	0.49	0/5639	0.63	0/7640

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

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	1841	0	1833	13	0
1	B	1895	0	1893	20	0
1	C	1820	0	1832	10	0
2	B	1	0	0	0	0
3	B	1	0	0	0	0
4	A	51	0	0	0	0
4	B	53	0	0	1	0
4	C	37	0	0	0	0
All	All	5699	0	5558	37	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 3.

All (37) 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:125:ARG:HH12	1:A:215:GLU:HG3	1.25	1.00
1:C:20:ILE:HD11	1:C:45:LEU:HD13	1.70	0.73
1:B:53:PHE:CE1	1:B:69:LEU:HD21	2.26	0.70
1:C:45:LEU:HD21	1:C:113:LEU:HD11	1.74	0.69
1:A:123:LEU:HD11	1:B:24:ASN:ND2	2.09	0.68
1:C:90:THR:HG23	1:C:93:GLY:H	1.60	0.66
1:C:45:LEU:CD2	1:C:113:LEU:HD11	2.27	0.64
1:A:125:ARG:NH1	1:A:215:GLU:HG3	2.06	0.62
1:B:113:LEU:HD13	1:B:224:ILE:HD12	1.82	0.62
1:A:53:PHE:HE1	1:A:69:LEU:HD21	1.64	0.61
1:A:23:TYR:HB2	1:A:224:ILE:HD13	1.84	0.58
1:B:20:ILE:HD11	1:B:45:LEU:HD13	1.86	0.57
1:A:75:VAL:HB	1:A:78:GLN:HB2	1.87	0.57
1:B:10:ALA:HB3	1:B:84:VAL:HG23	1.87	0.56
1:C:10:ALA:HB3	1:C:84:VAL:HG23	1.90	0.54
1:B:5:LYS:HG2	1:B:239:ARG:HD3	1.89	0.54
1:A:123:LEU:HD11	1:B:24:ASN:HD22	1.73	0.53
1:B:151:GLN:HG2	4:B:551:HOH:O	2.10	0.51
1:A:152:GLU:HG3	1:B:197:PRO:HD3	1.95	0.48
1:A:41:LEU:O	1:A:45:LEU:HG	2.13	0.48
1:C:128:LEU:HD22	1:C:207:THR:HG23	1.97	0.47
1:B:179:PHE:HA	1:B:186:LEU:HD11	1.98	0.46
1:C:179:PHE:HA	1:C:186:LEU:HD11	1.98	0.46
1:B:5:LYS:HG2	1:B:239:ARG:HH11	1.81	0.46
1:B:169:GLN:HB3	1:C:169:GLN:HG2	1.98	0.45
1:B:14:GLN:HA	1:B:46:ILE:HB	1.99	0.44
1:A:75:VAL:HG23	1:A:81:PRO:HD2	1.99	0.44
1:A:14:GLN:HA	1:A:46:ILE:HB	2.00	0.43
1:B:53:PHE:HE1	1:B:69:LEU:HD21	1.78	0.43
1:B:90:THR:HG23	1:B:93:GLY:H	1.84	0.42
1:C:45:LEU:HD21	1:C:113:LEU:CD1	2.45	0.42
1:B:60:LEU:HB3	1:B:67:GLU:HB2	2.01	0.42
1:B:51:SER:HA	1:C:81:PRO:HG3	2.03	0.41
1:A:51:SER:HA	1:B:81:PRO:HG3	2.03	0.41
1:A:43:GLU:HA	1:A:46:ILE:HG22	2.01	0.41
1:B:128:LEU:HD22	1:B:207:THR:HG23	2.02	0.40
1:B:213:ASP:HA	1:B:216:LYS:HD3	2.02	0.40

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	226/243 (93%)	221 (98%)	4 (2%)	1 (0%)	39	59
1	B	235/243 (97%)	233 (99%)	2 (1%)	0	100	100
1	C	224/243 (92%)	222 (99%)	2 (1%)	0	100	100
All	All	685/729 (94%)	676 (99%)	8 (1%)	1 (0%)	56	77

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	160	ALA

### 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	204/216 (94%)	196 (96%)	8 (4%)	39	64
1	B	211/216 (98%)	204 (97%)	7 (3%)	45	71
1	C	202/216 (94%)	191 (95%)	11 (5%)	27	47
All	All	617/648 (95%)	591 (96%)	26 (4%)	36	60

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	20	ILE
1	A	53	PHE

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Mol	Chain	Res	Type
1	A	69	LEU
1	A	71	ILE
1	A	125	ARG
1	A	201	SER
1	A	218	LYS
1	A	222	LEU
1	B	12	ILE
1	B	20	ILE
1	B	69	LEU
1	B	167	VAL
1	B	215	GLU
1	B	218	LYS
1	B	222	LEU
1	C	20	ILE
1	C	45	LEU
1	C	69	LEU
1	C	146	ARG
1	C	159	GLN
1	C	168	GLN
1	C	171	GLU
1	C	206	GLN
1	C	218	LYS
1	C	222	LEU
1	C	240	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	100	GLN
1	B	63	GLN
1	B	100	GLN
1	B	135	GLN
1	B	203	ASN
1	C	100	GLN

### 5.3.3 RNA ⓘ

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](#)

Of 2 ligands modelled in this entry, 2 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.

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	230/243 (94%)	0.09	2 (0%) 85 88	22, 49, 90, 127	0
1	B	237/243 (97%)	0.02	2 (0%) 87 89	23, 47, 85, 98	0
1	C	227/243 (93%)	0.18	7 (3%) 52 56	24, 52, 93, 123	0
All	All	694/729 (95%)	0.10	11 (1%) 74 77	22, 49, 90, 127	0

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	171	GLU	4.8
1	C	219	PHE	4.7
1	C	220	ASP	4.1
1	A	161	GLN	3.5
1	C	222	LEU	3.2
1	C	221	ASP	3.1
1	C	89	GLN	3.0
1	C	57	PRO	2.8
1	B	168	GLN	2.6
1	B	222	LEU	2.5
1	C	223	ASP	2.4

### 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](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
3	MG	B	401	1/1	0.96	0.10	-4.70	36,36,36,36	0
2	CL	B	400	1/1	0.96	0.12	-	57,57,57,57	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.