



# Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 5DU2  
Title : Structural analysis of EspG2 glycosyltransferase  
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(MCSG); Enzyme Discovery for Natural Product Biosynthesis (NatPro)  
Deposited on : unknown  
Resolution : 2.70 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
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20029824
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20029824

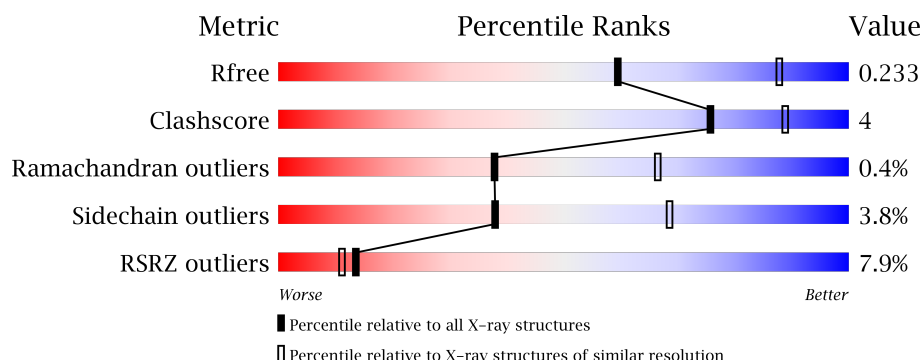
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.70 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))
$R_{free}$	100719	2259 (2.70-2.70)
Clashscore	112137	2590 (2.70-2.70)
Ramachandran outliers	110173	2550 (2.70-2.70)
Sidechain outliers	110143	2550 (2.70-2.70)
RSRZ outliers	101464	2275 (2.70-2.70)

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	419	<div> <div>5%</div> <div>75%</div> <div>11%</div> <div>13%</div> </div>
1	B	419	<div> <div>9%</div> <div>78%</div> <div>10%</div> <div>11%</div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5576 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 EspG2 glycosyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	365	Total	C	N	O	S	0	0	0
			2767	1741	511	506	9			
1	B	372	Total	C	N	O	S	0	0	0
			2803	1767	515	512	9			

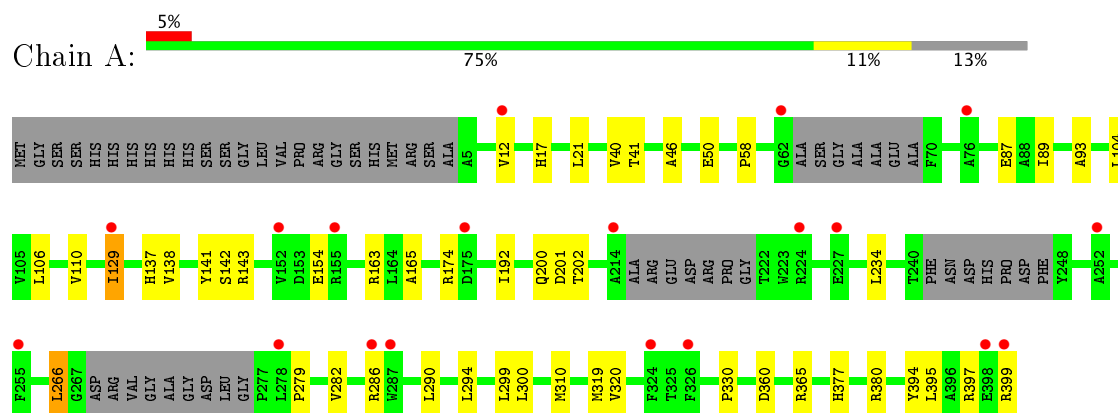
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	3	Total	O	0	0
			3	3		
2	B	3	Total	O	0	0
			3	3		

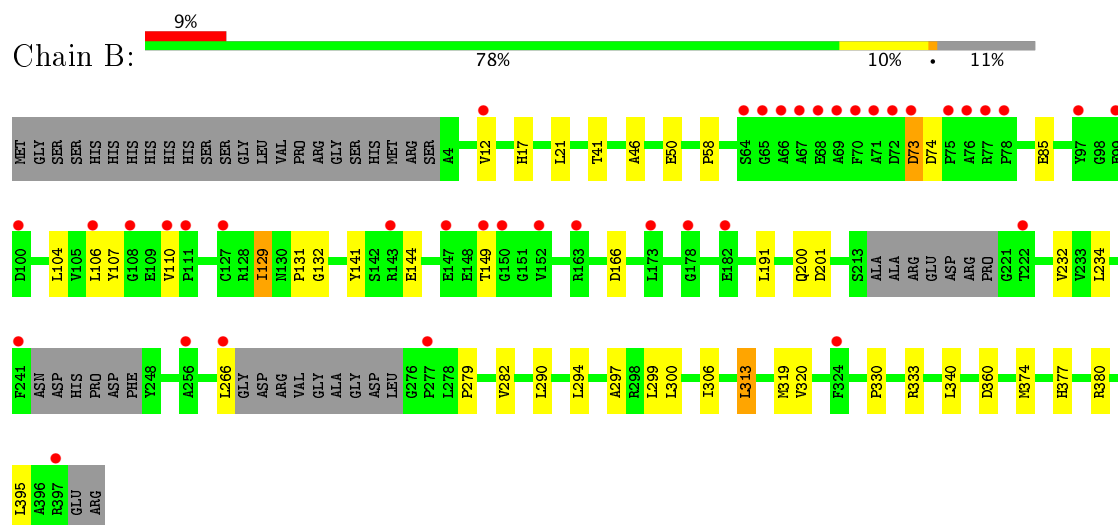
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of 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: EspG2 glycosyltransferase



- Molecule 1: EspG2 glycosyltransferase



## 4 Data and refinement statistics

Property	Value	Source
Space group	I 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	51.33Å 178.38Å 189.60Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.79 – 2.70 29.79 – 2.70	Depositor EDS
% Data completeness (in resolution range)	99.9 (29.79-2.70) 99.5 (29.79-2.70)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.74 (at 2.68Å)	Xtriage
Refinement program	BUSTER 2.10.0, REFMAC	Depositor
R, $R_{free}$	0.200 , 0.236 0.201 , 0.233	Depositor DCC
$R_{free}$ test set	1245 reflections (5.38%)	DCC
Wilson B-factor (Å <sup>2</sup> )	68.4	Xtriage
Anisotropy	0.760	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 59.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	5576	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	91.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.16% 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, 0.333 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	0.42	0/2825	0.57	0/3844
1	B	0.40	0/2864	0.57	0/3900
All	All	0.41	0/5689	0.57	0/7744

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	2767	0	2731	22	0
1	B	2803	0	2761	18	0
2	A	3	0	0	0	0
2	B	3	0	0	0	0
All	All	5576	0	5492	40	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 4.

All (40) 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:106:LEU:HG	1:A:129:ILE:HD11	1.77	0.66

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:106:LEU:HG	1:B:129:ILE:HD11	1.77	0.65
1:A:104:LEU:HB2	1:A:395:LEU:HD21	1.81	0.62
1:B:104:LEU:HB2	1:B:395:LEU:HD21	1.83	0.61
1:A:12:VAL:HG13	1:A:89:ILE:CG2	2.36	0.56
1:B:12:VAL:CG2	1:B:107:TYR:HB3	2.37	0.54
1:A:294:LEU:HD21	1:A:300:LEU:HB2	1.91	0.52
1:A:377:HIS:ND1	1:A:380:ARG:NH2	2.58	0.52
1:B:299:LEU:HD21	1:B:320:VAL:HG23	1.92	0.51
1:B:234:LEU:HD21	1:B:290:LEU:HG	1.92	0.51
1:A:299:LEU:HD21	1:A:320:VAL:HG23	1.92	0.51
1:A:192:ILE:HG22	1:A:310:MET:HE3	1.92	0.51
1:A:234:LEU:HD21	1:A:290:LEU:HG	1.93	0.49
1:B:294:LEU:HD21	1:B:300:LEU:HB2	1.94	0.49
1:B:377:HIS:ND1	1:B:380:ARG:NH1	2.61	0.49
1:B:46:ALA:O	1:B:50:GLU:HG3	2.13	0.48
1:A:46:ALA:O	1:A:50:GLU:HG3	2.13	0.48
1:B:41:THR:O	1:B:58:PRO:HA	2.14	0.47
1:B:132:GLY:HA2	1:B:306:ILE:HG12	1.97	0.47
1:A:41:THR:O	1:A:58:PRO:HA	2.14	0.46
1:A:395:LEU:C	1:A:397:ARG:H	2.18	0.46
1:A:394:TYR:CD1	1:A:399:ARG:HB3	2.50	0.46
1:A:12:VAL:HG13	1:A:89:ILE:HG21	1.98	0.46
1:B:232:VAL:HB	1:B:297:ALA:HA	1.98	0.45
1:A:279:PRO:HD2	1:A:282:VAL:HB	1.99	0.45
1:B:279:PRO:HD2	1:B:282:VAL:HB	1.98	0.45
1:A:87:GLU:OE1	1:A:163:ARG:NH1	2.50	0.45
1:A:138:VAL:HG11	1:A:202:THR:HG21	1.99	0.45
1:B:141:TYR:CE1	1:B:330:PRO:HG2	2.52	0.44
1:A:266:LEU:O	1:A:286:ARG:HA	2.18	0.44
1:B:17:HIS:O	1:B:21:LEU:HB2	2.18	0.43
1:B:313:LEU:HD11	1:B:340:LEU:HD13	2.00	0.43
1:B:313:LEU:HG	1:B:374:MET:HG3	2.01	0.43
1:A:137:HIS:HA	1:A:143:ARG:HH22	1.84	0.42
1:A:17:HIS:O	1:A:21:LEU:HB2	2.19	0.42
1:A:141:TYR:CE1	1:A:330:PRO:HG2	2.55	0.41
1:B:131:PRO:HA	1:B:191:LEU:HB2	2.03	0.41
1:B:144:GLU:CD	1:B:333:ARG:HH22	2.23	0.41
1:A:165:ALA:HB1	1:A:174:ARG:HG3	2.02	0.40
1:A:40:VAL:HG21	1:A:93:ALA:HB2	2.04	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	355/419 (85%)	346 (98%)	8 (2%)	1 (0%)	44	73
1	B	364/419 (87%)	352 (97%)	10 (3%)	2 (0%)	32	60
All	All	719/838 (86%)	698 (97%)	18 (2%)	3 (0%)	38	66

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	73	ASP
1	A	110	VAL
1	B	110	VAL

### 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	273/314 (87%)	264 (97%)	9 (3%)	43	73
1	B	274/314 (87%)	262 (96%)	12 (4%)	33	63
All	All	547/628 (87%)	526 (96%)	21 (4%)	38	68

All (21) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	129	ILE
1	A	142	SER
1	A	154	GLU

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Mol	Chain	Res	Type
1	A	200	GLN
1	A	201	ASP
1	A	266	LEU
1	A	319	MET
1	A	360	ASP
1	A	365	ARG
1	B	73	ASP
1	B	74	ASP
1	B	85	GLU
1	B	129	ILE
1	B	149	THR
1	B	166	ASP
1	B	200	GLN
1	B	201	ASP
1	B	266	LEU
1	B	313	LEU
1	B	319	MET
1	B	360	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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

### 6.1 Protein, DNA and RNA chains

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	365/419 (87%)	0.20	19 (5%) 28 26	51, 78, 134, 162	0
1	B	372/419 (88%)	0.38	39 (10%) 7 5	57, 91, 145, 177	0
All	All	737/838 (87%)	0.29	58 (7%) 13 11	51, 85, 142, 177	0

All (58) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	72	ASP	6.9
1	B	178	GLY	6.1
1	B	67	ALA	5.2
1	B	241	PHE	5.2
1	B	76	ALA	5.1
1	A	214	ALA	5.1
1	B	68	GLU	5.1
1	B	71	ALA	4.8
1	B	64	SER	4.8
1	B	70	PHE	4.5
1	B	75	PRO	4.3
1	B	66	ALA	3.8
1	B	69	ALA	3.7
1	A	399	ARG	3.6
1	B	147	GLU	3.4
1	B	97	TYR	3.3
1	B	65	GLY	3.3
1	A	398	GLU	3.1
1	B	99	GLU	3.1
1	B	152	VAL	3.1
1	A	278	LEU	3.0
1	B	397	ARG	3.0
1	B	77	ARG	2.9
1	B	150	GLY	2.8

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Mol	Chain	Res	Type	RSRZ
1	A	155	ARG	2.8
1	B	78	PRO	2.8
1	A	287	TRP	2.7
1	A	175	ASP	2.7
1	B	182	GLU	2.6
1	B	108	GLY	2.6
1	B	100	ASP	2.6
1	A	62	GLY	2.6
1	B	110	VAL	2.6
1	B	266	LEU	2.6
1	A	324	PHE	2.5
1	B	173	LEU	2.5
1	A	227	GLU	2.5
1	A	224	ARG	2.4
1	B	222	THR	2.4
1	B	73	ASP	2.4
1	A	286	ARG	2.3
1	B	324	PHE	2.3
1	B	106	LEU	2.3
1	A	12	VAL	2.3
1	A	252	ALA	2.3
1	B	143	ARG	2.3
1	A	152	VAL	2.2
1	B	127	CYS	2.2
1	B	163	ARG	2.2
1	B	277	PRO	2.1
1	B	149	THR	2.1
1	A	326	PHE	2.1
1	B	12	VAL	2.0
1	B	256	ALA	2.0
1	A	255	PHE	2.0
1	A	129	ILE	2.0
1	A	76	ALA	2.0
1	B	111	PRO	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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.