



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 17, 2020 – 01:26 pm BST

PDB ID : 4JTF  
Title : Crystal structure of F114R mutant of 3-deoxy-D-manno-octulosonate 8-phosphate synthase (KDO8PS) from *Neisseria meningitidis*  
Authors : Allison, T.M.; Cochrane, F.C.; Jameson, G.B.; Parker, E.J.  
Deposited on : 2013-03-23  
Resolution : 1.80 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](mailto: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.

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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 : 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

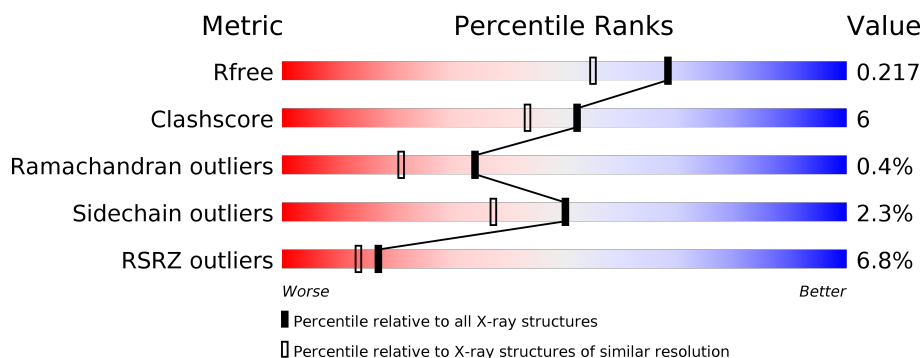
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 1.80 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	5950 (1.80-1.80)
Clashscore	141614	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)
RSRZ outliers	127900	5850 (1.80-1.80)

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 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	280	<div> <div>9%</div> <div> <div></div> <div>78%</div> <div>11%</div> <div>11%</div> </div> </div>
1	B	280	<div> <div>7%</div> <div> <div></div> <div>81%</div> <div>13%</div> <div>• •</div> </div> </div>
1	C	280	<div> <div>3%</div> <div> <div></div> <div>80%</div> <div>10%</div> <div>• 9%</div> </div> </div>
1	D	280	<div> <div>7%</div> <div> <div></div> <div>82%</div> <div>7%</div> <div>• 9%</div> </div> </div>

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 8443 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 2-dehydro-3-deoxyphosphooctonate aldolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	250	Total	C	N	O	S	0	2	0
			1927	1238	324	354	11			
1	B	268	Total	C	N	O	S	0	6	0
			2078	1331	355	381	11			
1	C	256	Total	C	N	O	S	0	2	0
			1985	1272	339	363	11			
1	D	255	Total	C	N	O	S	0	3	0
			1982	1271	336	364	11			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	114	ARG	PHE	ENGINEERED MUTATION	UNP Q9JZ55
B	114	ARG	PHE	ENGINEERED MUTATION	UNP Q9JZ55
C	114	ARG	PHE	ENGINEERED MUTATION	UNP Q9JZ55
D	114	ARG	PHE	ENGINEERED MUTATION	UNP Q9JZ55

- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total	C	O	0	0
			6	3	3		
2	D	1	Total	C	O	0	0
			6	3	3		

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	2	Total	Cl	0	0
			2	2		
3	D	2	Total	Cl	0	0
			2	2		
3	C	2	Total	Cl	0	0
			2	2		

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	C	1	Total	Na	0	0
			1	1		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	97	Total	O	0	0
			97	97		

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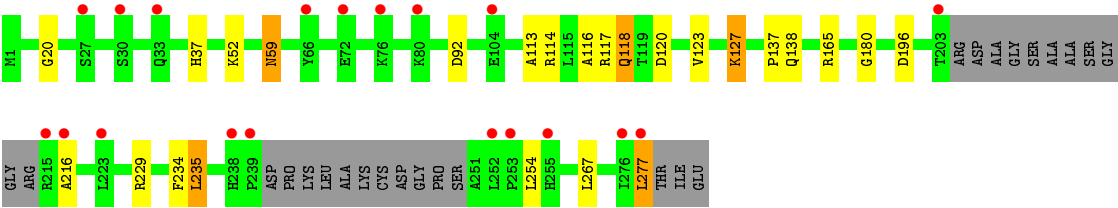
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	B	119	Total 119	O 119	0	0
5	C	115	Total 115	O 115	0	0
5	D	121	Total 121	O 121	0	0



- Molecule 1: 2-dehydro-3-deoxyphosphooctonate aldolase





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	81.86Å 85.20Å 163.36Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.70 – 1.80 39.70 – 1.80	Depositor EDS
% Data completeness (in resolution range)	98.6 (39.70-1.80) 98.7 (39.70-1.80)	Depositor EDS
$R_{merge}$	0.04	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.85 (at 1.79Å)	Xtriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.185 , 0.215 0.191 , 0.217	Depositor DCC
$R_{free}$ test set	5270 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	31.1	Xtriage
Anisotropy	0.233	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 43.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	0.010 for k,h,-l	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	8443	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	33.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.81% 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

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

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	0.89	0/1961	0.86	2/2650 (0.1%)
1	B	0.99	0/2119	0.93	2/2868 (0.1%)
1	C	0.93	1/2021 (0.0%)	0.91	2/2732 (0.1%)
1	D	0.87	1/2019 (0.0%)	0.86	2/2731 (0.1%)
All	All	0.92	2/8120 (0.0%)	0.89	8/10981 (0.1%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	104	GLU	CD-OE2	-5.89	1.19	1.25
1	D	216	ALA	C-O	5.70	1.34	1.23

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	92	ASP	CB-CG-OD1	5.98	123.68	118.30
1	C	60	ARG	NE-CZ-NH2	5.94	123.27	120.30
1	A	234	PHE	CB-CA-C	-5.49	99.42	110.40
1	A	92	ASP	CB-CG-OD1	5.43	123.18	118.30
1	B	174	LEU	CA-CB-CG	5.17	127.18	115.30

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	1927	0	1972	23	0
1	B	2078	0	2129	38	0
1	C	1985	0	2037	19	0
1	D	1982	0	2033	19	0
2	B	6	0	8	0	0
2	D	6	0	8	0	0
3	B	2	0	0	0	0
3	C	2	0	0	0	0
3	D	2	0	0	1	0
4	C	1	0	0	0	0
5	A	97	0	0	2	0
5	B	119	0	0	3	0
5	C	115	0	0	1	0
5	D	121	0	0	5	0
All	All	8443	0	8187	89	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 6.

The worst 5 of 89 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:C:43:ARG:HD3	5:C:502:HOH:O	1.77	0.83
1:D:123:VAL:O	1:D:127:LYS:HD2	1.81	0.79
1:A:183:VAL:HG21	1:B:214:ARG:HG2	1.69	0.74
1:A:4:LYS:NZ	1:A:6:ASN:O	2.21	0.74
1:B:93[A]:VAL:CG2	1:B:125:MET:HE2	2.18	0.74

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	246/280 (88%)	242 (98%)	3 (1%)	1 (0%)	34	21
1	B	270/280 (96%)	263 (97%)	6 (2%)	1 (0%)	34	21
1	C	252/280 (90%)	249 (99%)	2 (1%)	1 (0%)	34	21
1	D	252/280 (90%)	247 (98%)	4 (2%)	1 (0%)	34	21
All	All	1020/1120 (91%)	1001 (98%)	15 (2%)	4 (0%)	34	21

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	229	ARG
1	A	229	ARG
1	C	229	ARG
1	D	229	ARG

### 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	212/236 (90%)	206 (97%)	6 (3%)	43	30
1	B	228/236 (97%)	221 (97%)	7 (3%)	40	25
1	C	220/236 (93%)	217 (99%)	3 (1%)	67	59
1	D	221/236 (94%)	216 (98%)	5 (2%)	50	37
All	All	881/944 (93%)	860 (98%)	21 (2%)	50	36

5 of 21 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	234[A]	PHE
1	B	252	LEU
1	D	118	GLN
1	B	174	LEU
1	D	127	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such

sidechains are listed below:

Mol	Chain	Res	Type
1	C	97	HIS
1	C	100	GLN
1	D	23	ASN
1	B	238	HIS
1	C	274	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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

Of 9 ligands modelled in this entry, 7 are monoatomic - leaving 2 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
2	GOL	B	301	-	5,5,5	0.91	0	5,5,5	2.14	1 (20%)
2	GOL	D	301	-	5,5,5	0.76	0	5,5,5	0.84	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GOL	B	301	-	-	4/4/4/4	-
2	GOL	D	301	-	-	0/4/4/4	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	301	GOL	O1-C1-C2	-4.16	90.24	110.20

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	301	GOL	O1-C1-C2-O2
2	B	301	GOL	O1-C1-C2-C3
2	B	301	GOL	O2-C2-C3-O3
2	B	301	GOL	C1-C2-C3-O3

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	250/280 (89%)	0.40	24 (9%) 8 6	19, 33, 64, 82	1 (0%)
1	B	268/280 (95%)	0.27	19 (7%) 16 12	20, 29, 50, 79	0
1	C	256/280 (91%)	-0.01	8 (3%) 49 43	20, 29, 50, 78	0
1	D	255/280 (91%)	0.39	19 (7%) 14 11	20, 30, 54, 75	0
All	All	1029/1120 (91%)	0.26	70 (6%) 17 13	19, 30, 56, 82	1 (0%)

The worst 5 of 70 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	66	TYR	8.0
1	B	239	PRO	8.0
1	B	279	ILE	6.6
1	B	256	LEU	6.2
1	A	61	SER	5.8

### 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. 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	B-factors( $\text{\AA}^2$ )	Q<0.9
2	GOL	B	301	6/6	0.87	0.15	30,32,36,41	0
2	GOL	D	301	6/6	0.89	0.13	32,32,37,41	0
3	CL	C	302	1/1	0.90	0.07	40,40,40,40	0
3	CL	D	303	1/1	0.95	0.07	40,40,40,40	0
3	CL	D	302	1/1	0.97	0.09	34,34,34,34	0
4	NA	C	303	1/1	0.98	0.08	28,28,28,28	0
3	CL	B	302	1/1	0.99	0.11	28,28,28,28	0
3	CL	C	301	1/1	0.99	0.09	34,34,34,34	0
3	CL	B	303	1/1	0.99	0.14	36,36,36,36	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.