



# wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 21, 2024 – 01:42 PM EDT

PDB ID : 2IDB  
Title : Crystal Structure of 3-octaprenyl-4-hydroxybenzoate decarboxylase (UbiD) from Escherichia coli, Northeast Structural Genomics Target ER459.  
Authors : Zhou, W.; Forouhar, F.; Seetharaman, J.; Fang, Y.; Xiao, R.; Cunningham, K.; Ma, L.-C.; Chen, C.X.; Acton, T.B.; Montelione, G.T.; Hunt, J.F.; Tong, L.; Northeast Structural Genomics Consortium (NESG)  
Deposited on : 2006-09-14  
Resolution : 2.90 Å(reported)

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We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

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<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>.

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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	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.20.1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

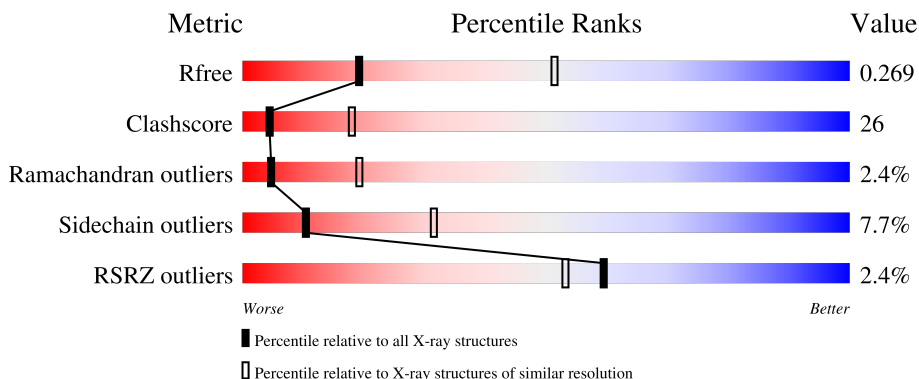
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.90 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))
$R_{free}$	164625	2335 (2.90-2.90)
Clashscore	180529	2564 (2.90-2.90)
Ramachandran outliers	177936	2514 (2.90-2.90)
Sidechain outliers	177891	2516 (2.90-2.90)
RSRZ outliers	164620	2337 (2.90-2.90)

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  $\geq 3$ , 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	505	
1	B	505	
1	C	505	

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 11118 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 3-octaprenyl-4-hydroxybenzoate carboxy-lyase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	474	Total	C	N	O	S	Se	0	0	0
			3734	2390	634	692	7	11			
1	B	455	Total	C	N	O	S	Se	0	0	0
			3576	2284	611	663	7	11			
1	C	456	Total	C	N	O	S	Se	0	0	0
			3594	2300	613	664	7	10			

There are 63 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MSE	MET	modified residue	UNP P0AAB4
A	4	MSE	MET	modified residue	UNP P0AAB4
A	60	MSE	MET	modified residue	UNP P0AAB4
A	75	MSE	MET	modified residue	UNP P0AAB4
A	77	MSE	MET	modified residue	UNP P0AAB4
A	120	MSE	MET	modified residue	UNP P0AAB4
A	148	MSE	MET	modified residue	UNP P0AAB4
A	191	MSE	MET	modified residue	UNP P0AAB4
A	382	MSE	MET	modified residue	UNP P0AAB4
A	383	MSE	MET	modified residue	UNP P0AAB4
A	393	MSE	MET	modified residue	UNP P0AAB4
A	421	MSE	MET	modified residue	UNP P0AAB4
A	451	MSE	MET	modified residue	UNP P0AAB4
A	498	LEU	-	expression tag	UNP P0AAB4
A	499	GLU	-	expression tag	UNP P0AAB4
A	500	HIS	-	expression tag	UNP P0AAB4
A	501	HIS	-	expression tag	UNP P0AAB4
A	502	HIS	-	expression tag	UNP P0AAB4
A	503	HIS	-	expression tag	UNP P0AAB4
A	504	HIS	-	expression tag	UNP P0AAB4
A	505	HIS	-	expression tag	UNP P0AAB4
B	1	MSE	MET	modified residue	UNP P0AAB4
B	4	MSE	MET	modified residue	UNP P0AAB4

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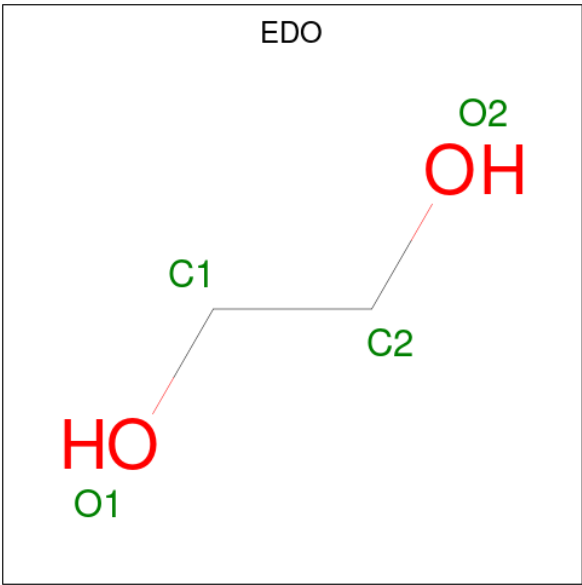
Chain	Residue	Modelled	Actual	Comment	Reference
B	60	MSE	MET	modified residue	UNP P0AAB4
B	75	MSE	MET	modified residue	UNP P0AAB4
B	77	MSE	MET	modified residue	UNP P0AAB4
B	120	MSE	MET	modified residue	UNP P0AAB4
B	148	MSE	MET	modified residue	UNP P0AAB4
B	191	MSE	MET	modified residue	UNP P0AAB4
B	382	MSE	MET	modified residue	UNP P0AAB4
B	383	MSE	MET	modified residue	UNP P0AAB4
B	393	MSE	MET	modified residue	UNP P0AAB4
B	421	MSE	MET	modified residue	UNP P0AAB4
B	451	MSE	MET	modified residue	UNP P0AAB4
B	498	LEU	-	expression tag	UNP P0AAB4
B	499	GLU	-	expression tag	UNP P0AAB4
B	500	HIS	-	expression tag	UNP P0AAB4
B	501	HIS	-	expression tag	UNP P0AAB4
B	502	HIS	-	expression tag	UNP P0AAB4
B	503	HIS	-	expression tag	UNP P0AAB4
B	504	HIS	-	expression tag	UNP P0AAB4
B	505	HIS	-	expression tag	UNP P0AAB4
C	1	MSE	MET	modified residue	UNP P0AAB4
C	4	MSE	MET	modified residue	UNP P0AAB4
C	60	MSE	MET	modified residue	UNP P0AAB4
C	75	MSE	MET	modified residue	UNP P0AAB4
C	77	MSE	MET	modified residue	UNP P0AAB4
C	120	MSE	MET	modified residue	UNP P0AAB4
C	148	MSE	MET	modified residue	UNP P0AAB4
C	191	MSE	MET	modified residue	UNP P0AAB4
C	382	MSE	MET	modified residue	UNP P0AAB4
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C	393	MSE	MET	modified residue	UNP P0AAB4
C	421	MSE	MET	modified residue	UNP P0AAB4
C	451	MSE	MET	modified residue	UNP P0AAB4
C	498	LEU	-	expression tag	UNP P0AAB4
C	499	GLU	-	expression tag	UNP P0AAB4
C	500	HIS	-	expression tag	UNP P0AAB4
C	501	HIS	-	expression tag	UNP P0AAB4
C	502	HIS	-	expression tag	UNP P0AAB4
C	503	HIS	-	expression tag	UNP P0AAB4
C	504	HIS	-	expression tag	UNP P0AAB4
C	505	HIS	-	expression tag	UNP P0AAB4

- Molecule 2 is PENTAETHYLENE GLYCOL (three-letter code: 1PE) (formula: C<sub>10</sub>H<sub>22</sub>O<sub>6</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			16	10	6		
2	B	1	Total	C	O	0	0
			16	10	6		
2	C	1	Total	C	O	0	0
			16	10	6		

- Molecule 3 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			4	2	2		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	C	1	Total	C	O	0	0
			4	2	2		
3	C	1	Total	C	O	0	0
			4	2	2		

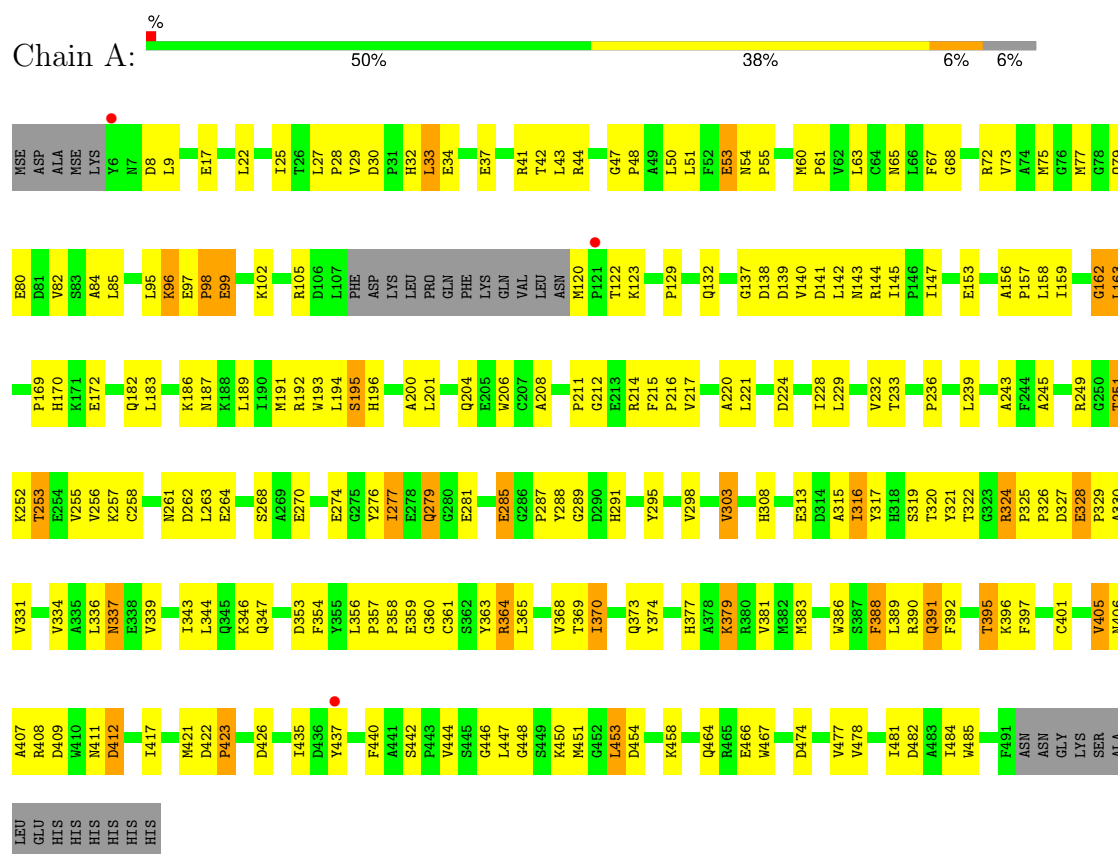
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	64	Total	O	0	0
			64	64		
4	B	46	Total	O	0	0
			46	46		
4	C	44	Total	O	0	0
			44	44		

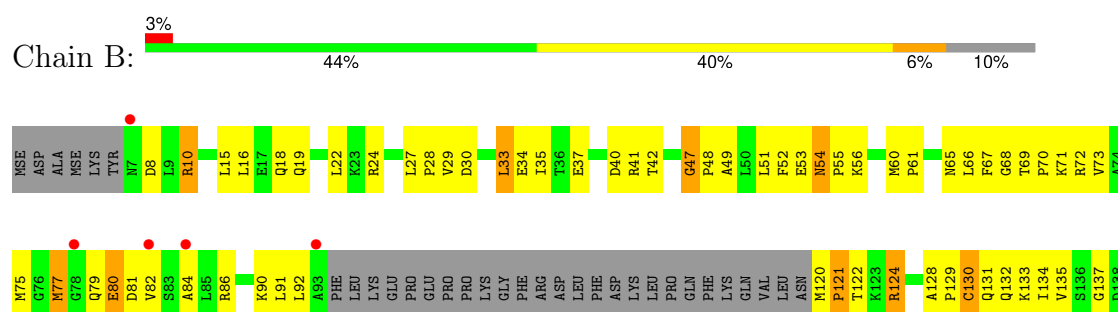
### 3 Residue-property plots [i](#)

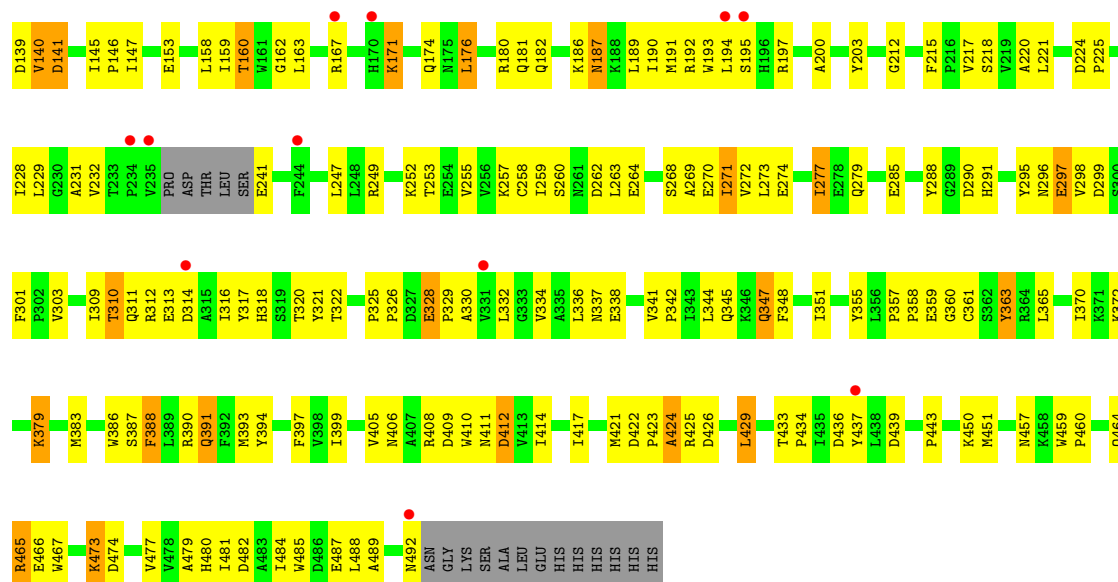
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: 3-octaprenyl-4-hydroxybenzoate carboxy-lyase

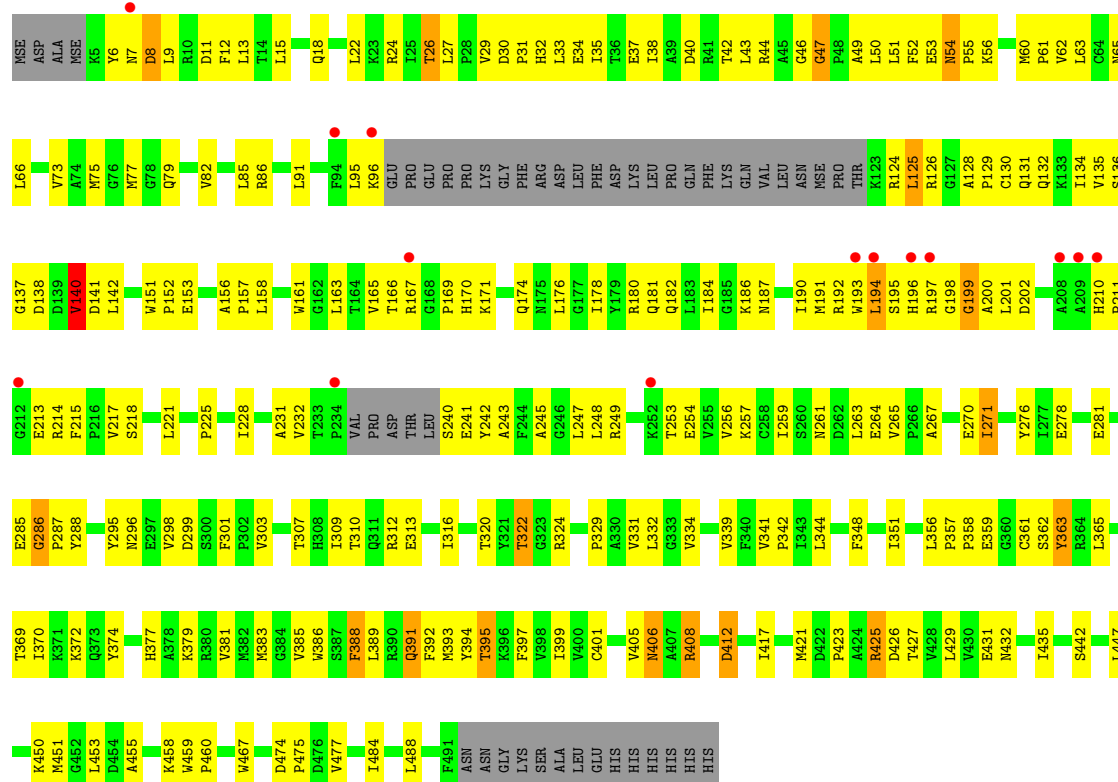


- Molecule 1: 3-octaprenyl-4-hydroxybenzoate carboxy-lyase





• Molecule 1: 3-octaprenyl-4-hydroxybenzoate carboxy-lyase





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	194.29Å 194.29Å 106.05Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.20 – 2.90 40.20 – 2.90	Depositor EDS
% Data completeness (in resolution range)	89.8 (40.20-2.90) 94.9 (40.20-2.90)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	0.09	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.66 (at 2.81Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, $R_{free}$	0.201 , 0.265 0.207 , 0.269	Depositor DCC
$R_{free}$ test set	4483 reflections (9.87%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	44.8	Xtriage
Anisotropy	0.094	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 57.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.91	EDS
Total number of atoms	11118	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.34% 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: EDO, 1PE

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	0.45	0/3821	0.65	0/5190
1	B	0.41	0/3655	0.61	0/4962
1	C	0.40	0/3674	0.62	0/4984
All	All	0.42	0/11150	0.63	0/15136

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	3734	0	3697	197	0
1	B	3576	0	3540	211	0
1	C	3594	0	3562	186	0
2	A	16	0	22	1	0
2	B	16	0	22	0	0
2	C	16	0	22	1	0
3	A	4	0	6	0	0
3	C	8	0	12	0	0
4	A	64	0	0	3	0
4	B	46	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	C	44	0	0	2	0
All	All	11118	0	10883	567	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 26.

The worst 5 of 567 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:B:249:ARG:HH12	1:B:253:THR:HG22	1.13	1.07
1:A:389:LEU:HB3	1:A:391:GLN:HE21	1.20	1.05
1:C:161:TRP:HE1	1:C:228:ILE:HD12	1.22	1.01
1:A:215:PHE:HB3	1:A:277:ILE:HG23	1.47	0.97
1:C:125:LEU:HD21	1:C:128:ALA:HB2	1.46	0.96

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	470/505 (93%)	426 (91%)	36 (8%)	8 (2%)	7	27
1	B	449/505 (89%)	392 (87%)	42 (9%)	15 (3%)	3	13
1	C	450/505 (89%)	401 (89%)	39 (9%)	10 (2%)	5	21
All	All	1369/1515 (90%)	1219 (89%)	117 (8%)	33 (2%)	5	19

5 of 33 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	33	LEU
1	A	47	GLY

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Mol	Chain	Res	Type
1	B	33	LEU
1	B	194	LEU
1	C	33	LEU

### 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	402/417 (96%)	366 (91%)	36 (9%)	8	25
1	B	384/417 (92%)	356 (93%)	28 (7%)	11	34
1	C	385/417 (92%)	359 (93%)	26 (7%)	13	38
All	All	1171/1251 (94%)	1081 (92%)	90 (8%)	10	31

5 of 90 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	412	ASP
1	C	140	VAL
1	B	437	TYR
1	C	26	THR
1	C	271	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 34 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	204	GLN
1	C	210	HIS
1	C	406	ASN
1	B	175	ASN
1	B	54	ASN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry ⓘ

6 ligands are modelled in this entry.

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	1PE	C	506	-	15,15,15	0.48	0	14,14,14	0.51	0
2	1PE	B	506	-	15,15,15	0.38	0	14,14,14	0.57	0
2	1PE	A	506	-	15,15,15	0.39	0	14,14,14	0.63	0
3	EDO	A	507	-	3,3,3	0.66	0	2,2,2	0.72	0
3	EDO	C	507	-	3,3,3	0.67	0	2,2,2	0.82	0
3	EDO	C	508	-	3,3,3	0.47	0	2,2,2	0.58	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	1PE	C	506	-	-	7/13/13/13	-
2	1PE	B	506	-	-	7/13/13/13	-
2	1PE	A	506	-	-	5/13/13/13	-
3	EDO	A	507	-	-	1/1/1/1	-
3	EDO	C	507	-	-	1/1/1/1	-
3	EDO	C	508	-	-	1/1/1/1	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 22 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	506	1PE	OH6-C15-C25-OH5
2	C	506	1PE	OH7-C16-C26-OH6
2	B	506	1PE	OH6-C15-C25-OH5
2	B	506	1PE	OH5-C14-C24-OH4
2	A	506	1PE	C16-C26-OH6-C15

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	506	1PE	1	0
2	A	506	1PE	1	0

## 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	463/505 (91%)	-0.29	3 (0%) 85 82	10, 32, 61, 77	0
1	B	444/505 (87%)	0.11	16 (3%) 46 40	11, 45, 80, 97	0
1	C	446/505 (88%)	0.07	14 (3%) 51 46	12, 42, 79, 96	0
All	All	1353/1515 (89%)	-0.04	33 (2%) 59 53	10, 39, 76, 97	0

The worst 5 of 33 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	235	VAL	3.7
1	A	6	TYR	3.2
1	B	244	PHE	3.1
1	C	234	PRO	3.1
1	B	492	ASN	2.9

### 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](#)

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
3	EDO	A	507	4/4	0.80	0.17	40,40,42,43	0
3	EDO	C	507	4/4	0.82	0.15	47,50,50,50	0
2	1PE	A	506	16/16	0.85	0.16	52,54,57,58	0
2	1PE	B	506	16/16	0.86	0.16	67,71,78,78	0
2	1PE	C	506	16/16	0.86	0.14	70,72,74,74	0
3	EDO	C	508	4/4	0.93	0.12	34,37,38,39	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.