



# Full wwPDB X-ray Structure Validation Report ⓘ

Jan 31, 2016 – 11:31 PM GMT

PDB ID : 1XK7  
Title : Crystal Structure- C2 form- of Escherichia coli Crotonobetainyl-CoA: carnitine CoA transferase (CaiB)  
Authors : Rangarajan, E.S.; Li, Y.; Iannuzzi, P.; Cygler, M.; Matte, A.; Montreal-Kingston Bacterial Structural Genomics Initiative (BSGI)  
Deposited on : 2004-09-27  
Resolution : 1.60 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 : 1.7 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
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) : trunk26865

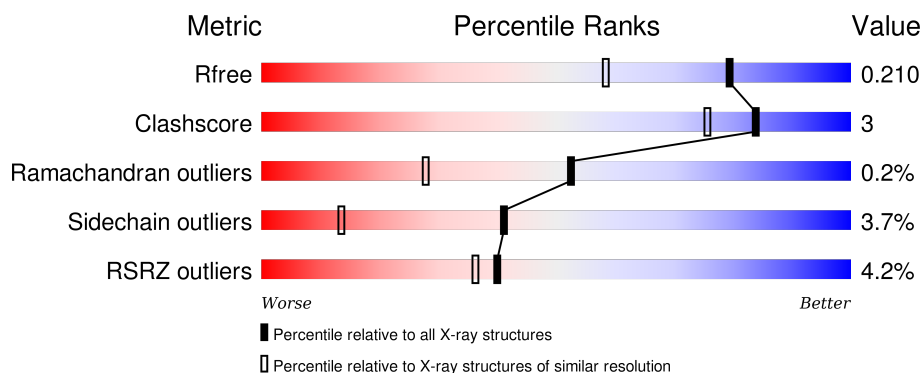
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 1.60 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))
$R_{free}$	91344	2475 (1.60-1.60)
Clashscore	102246	2732 (1.60-1.60)
Ramachandran outliers	100387	2654 (1.60-1.60)
Sidechain outliers	100360	2653 (1.60-1.60)
RSRZ outliers	91569	2479 (1.60-1.60)

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	408	<div> <div>3%</div> <div>92%</div> <div>7%</div> </div>
1	B	408	<div> <div>3%</div> <div>92%</div> <div>6%</div> </div>
1	C	408	<div> <div>6%</div> <div>93%</div> <div>6%</div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 10735 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 Crotonobetainyl-CoA:carnitine CoA-transferase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	407	Total	C	N	O	S	Se	0	0	0
			3187	2038	531	594	7	17			
1	B	407	Total	C	N	O	S	Se	0	0	0
			3187	2038	531	594	7	17			
1	C	407	Total	C	N	O	S	Se	0	0	0
			3187	2038	531	594	7	17			

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	CLONING ARTIFACT	UNP P31572
A	-1	SER	-	CLONING ARTIFACT	UNP P31572
A	0	HIS	-	CLONING ARTIFACT	UNP P31572
B	-2	GLY	-	CLONING ARTIFACT	UNP P31572
B	-1	SER	-	CLONING ARTIFACT	UNP P31572
B	0	HIS	-	CLONING ARTIFACT	UNP P31572
C	-2	GLY	-	CLONING ARTIFACT	UNP P31572
C	-1	SER	-	CLONING ARTIFACT	UNP P31572
C	0	HIS	-	CLONING ARTIFACT	UNP P31572

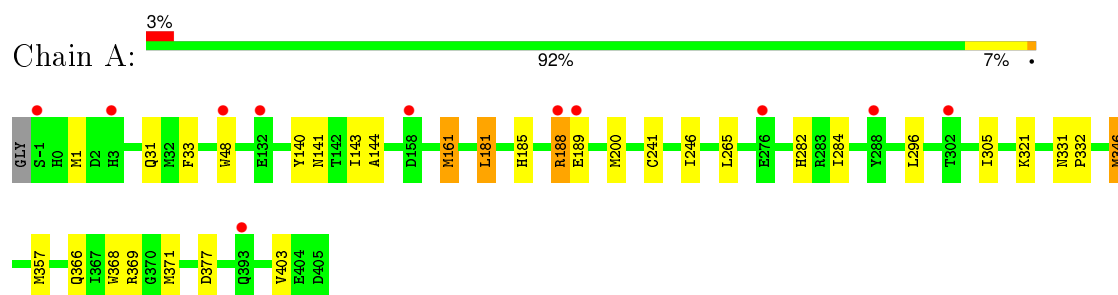
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	381	Total	O	0	0
			381	381		
2	B	383	Total	O	0	0
			383	383		
2	C	410	Total	O	0	0
			410	410		

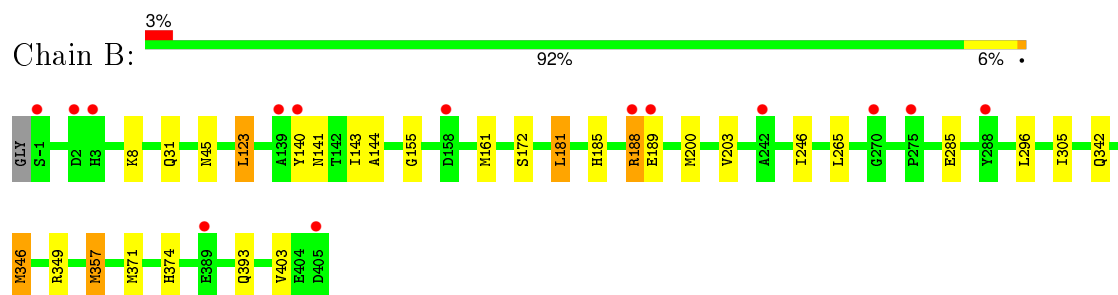
### 3 Residue-property plots [i](#)

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.

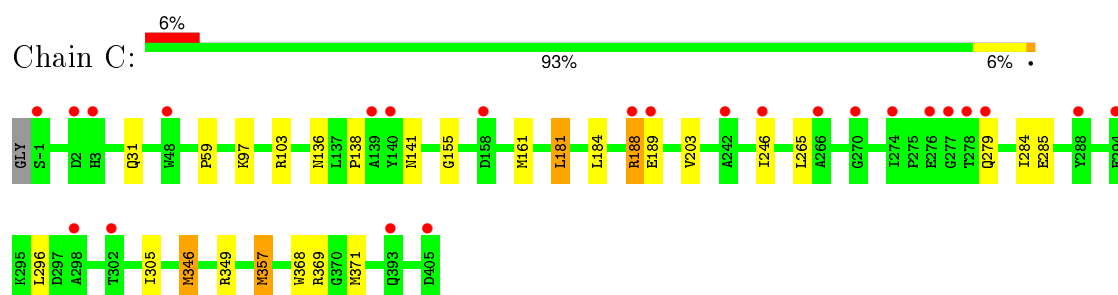
- Molecule 1: Crotonobetainyl-CoA:carnitine CoA-transferase



- Molecule 1: Crotonobetainyl-CoA:carnitine CoA-transferase



- Molecule 1: Crotonobetainyl-CoA:carnitine CoA-transferase



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	184.28 Å   106.17 Å   69.68 Å 90.00°   107.45°   90.00°	Depositor
Resolution (Å)	45.44 – 1.60 45.44 – 1.60	Depositor EDS
% Data completeness (in resolution range)	99.7 (45.44-1.60) 99.9 (45.44-1.60)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.08	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.86 (at 1.60 Å)	Xtriage
Refinement program	REFMAC 5.1.24	Depositor
R, $R_{free}$	0.187   ,   0.213 0.184   ,   0.210	Depositor DCC
$R_{free}$ test set	8476 reflections (5.31%)	DCC
Wilson B-factor (Å <sup>2</sup> )	14.9	Xtriage
Anisotropy	0.043	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 48.8	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	0 of 168001 reflections	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	10735	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	19.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.38% 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 [i](#)

### 5.1 Standard geometry [i](#)

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	0.33	0/3251	0.63	1/4380 (0.0%)
1	B	0.33	0/3251	0.63	0/4380
1	C	0.34	0/3251	0.63	0/4380
All	All	0.34	0/9753	0.63	1/13140 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	377	ASP	CB-CG-OD2	5.21	122.99	118.30

There are no chirality outliers.

There are no planarity outliers.

### 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	3187	0	3122	19	0
1	B	3187	0	3122	24	0
1	C	3187	0	3122	25	0
2	A	381	0	0	1	0
2	B	383	0	0	1	0
2	C	410	0	0	3	0
All	All	10735	0	9366	56	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 (56) 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:185:HIS:HA	1:B:188:ARG:HH22	1.02	1.18
1:A:185:HIS:HA	1:A:188:ARG:HH22	1.08	1.15
1:B:161:MSE:HE1	1:C:155:GLY:HA2	1.32	1.11
1:B:155:GLY:HA2	1:C:161:MSE:HE1	1.35	1.04
1:B:185:HIS:HA	1:B:188:ARG:NH2	1.77	0.99
1:A:185:HIS:HA	1:A:188:ARG:NH2	1.89	0.86
1:A:188:ARG:HH21	1:A:188:ARG:HB2	1.42	0.85
1:B:155:GLY:CA	1:C:161:MSE:HE1	2.06	0.84
1:B:161:MSE:HE1	1:C:155:GLY:CA	2.10	0.81
1:C:184:LEU:HG	1:C:188:ARG:HH12	1.45	0.80
1:A:366:GLN:HE22	1:B:342:GLN:HE22	1.34	0.74
1:C:346:MSE:HG3	1:C:371:MSE:O	1.91	0.71
1:A:346:MSE:HG3	1:A:371:MSE:O	1.93	0.67
1:A:284:ILE:HD12	1:A:284:ILE:H	1.61	0.66
1:B:346:MSE:HG3	1:B:371:MSE:O	1.98	0.62
1:B:161:MSE:HE2	2:C:546:HOH:O	1.99	0.61
1:C:284:ILE:H	1:C:284:ILE:HD12	1.67	0.59
1:A:188:ARG:HH21	1:A:188:ARG:CB	2.15	0.58
1:A:284:ILE:N	1:A:284:ILE:HD12	2.20	0.56
1:C:184:LEU:HG	1:C:188:ARG:NH1	2.19	0.55
1:B:357:MSE:HE1	1:C:203:VAL:HG22	1.88	0.54
1:A:305:ILE:HD13	1:A:321:LYS:HE2	1.90	0.54
1:B:393:GLN:NE2	2:B:741:HOH:O	2.36	0.54
1:B:203:VAL:HG22	1:C:357:MSE:HE1	1.88	0.54
1:C:284:ILE:N	1:C:284:ILE:HD12	2.23	0.52
1:B:357:MSE:CE	1:C:203:VAL:HG22	2.41	0.50
1:A:282:HIS:CE1	1:A:284:ILE:HD13	2.47	0.49
1:B:188:ARG:NH2	1:C:188:ARG:HE	2.11	0.49
1:B:123:LEU:HD21	1:B:172:SER:HB3	1.95	0.49
1:C:97:LYS:HG2	1:C:138:PRO:HA	1.94	0.48
1:B:140:TYR:HB2	1:B:143:ILE:HD12	1.95	0.48
1:A:366:GLN:HE22	1:B:342:GLN:NE2	2.07	0.48
1:C:161:MSE:HE2	2:C:546:HOH:O	2.14	0.47
1:B:45:ASN:O	1:B:374:HIS:HE1	1.98	0.47
1:B:203:VAL:HG22	1:C:357:MSE:CE	2.46	0.46
1:A:33:PHE:HE2	1:A:181:LEU:HD13	1.84	0.43
1:B:144:ALA:HB2	1:B:200:MSE:HE2	2.01	0.43
1:B:144:ALA:CB	1:B:200:MSE:HE2	2.49	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:184:LEU:HG	1:C:188:ARG:HH22	1.83	0.43
1:C:59:PRO:HB2	1:C:371:MSE:SE	2.68	0.42
1:B:181:LEU:HB3	1:C:181:LEU:HB3	2.01	0.42
1:C:161:MSE:HB2	1:C:161:MSE:HE2	1.73	0.42
1:C:369:ARG:HB3	2:C:461:HOH:O	2.18	0.42
1:A:140:TYR:HB2	1:A:143:ILE:HD12	2.00	0.42
1:C:103:ARG:NH2	1:C:136:ASN:OD1	2.52	0.42
1:C:357:MSE:HE2	1:C:357:MSE:HB2	1.86	0.42
1:A:161:MSE:HB2	1:A:161:MSE:HE2	1.66	0.42
1:A:331:ASN:HA	1:A:332:PRO:HD3	1.95	0.41
1:A:144:ALA:HB2	1:A:200:MSE:HE2	2.02	0.41
1:C:368:TRP:CE3	1:C:369:ARG:HB2	2.55	0.41
1:A:368:TRP:CE3	1:A:369:ARG:HB2	2.54	0.41
1:A:369:ARG:HB3	2:A:567:HOH:O	2.19	0.41
1:B:246:ILE:HG23	1:B:305:ILE:HD12	2.02	0.41
1:B:246:ILE:HG23	1:B:305:ILE:CD1	2.51	0.41
1:C:246:ILE:HG23	1:C:305:ILE:CD1	2.50	0.41
1:A:241:CYS:SG	1:A:246:ILE:HG12	2.62	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	405/408 (99%)	395 (98%)	9 (2%)	1 (0%)	52	28
1	B	405/408 (99%)	395 (98%)	9 (2%)	1 (0%)	52	28
1	C	405/408 (99%)	397 (98%)	8 (2%)	0	100	100
All	All	1215/1224 (99%)	1187 (98%)	26 (2%)	2 (0%)	52	28

All (2) Ramachandran outliers are listed below:



Mol	Chain	Res	Type
1	A	403	VAL
1	B	403	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	334/317 (105%)	322 (96%)	12 (4%)	42	15
1	B	334/317 (105%)	321 (96%)	13 (4%)	39	13
1	C	334/317 (105%)	322 (96%)	12 (4%)	42	15
All	All	1002/951 (105%)	965 (96%)	37 (4%)	41	13

All (37) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MSE
1	A	31	GLN
1	A	48	TRP
1	A	141	ASN
1	A	161	MSE
1	A	181	LEU
1	A	188	ARG
1	A	189	GLU
1	A	265	LEU
1	A	296	LEU
1	A	346	MSE
1	A	357	MSE
1	B	8	LYS
1	B	31	GLN
1	B	123	LEU
1	B	141	ASN
1	B	181	LEU
1	B	188	ARG
1	B	189	GLU
1	B	265	LEU
1	B	285	GLU

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Mol	Chain	Res	Type
1	B	296	LEU
1	B	346	MSE
1	B	349	ARG
1	B	357	MSE
1	C	31	GLN
1	C	141	ASN
1	C	181	LEU
1	C	188	ARG
1	C	189	GLU
1	C	265	LEU
1	C	279	GLN
1	C	285	GLU
1	C	296	LEU
1	C	346	MSE
1	C	349	ARG
1	C	357	MSE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	31	GLN
1	A	209	GLN
1	A	267	HIS
1	A	344	GLN
1	A	374	HIS
1	A	384	ASN
1	B	31	GLN
1	B	209	GLN
1	B	267	HIS
1	B	342	GLN
1	B	344	GLN
1	B	374	HIS
1	B	384	ASN
1	C	31	GLN
1	C	55	GLN
1	C	209	GLN
1	C	374	HIS
1	C	384	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 ⓘ

### 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	390/408 (95%)	0.13	11 (2%) 56 54	10, 18, 33, 39	0
1	B	390/408 (95%)	0.05	14 (3%) 46 43	10, 15, 30, 37	0
1	C	390/408 (95%)	0.19	24 (6%) 24 21	9, 16, 29, 35	0
All	All	1170/1224 (95%)	0.12	49 (4%) 40 36	9, 16, 32, 39	0

All (49) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	48	TRP	6.5
1	C	188	ARG	4.8
1	B	140	TYR	4.5
1	C	189	GLU	3.8
1	A	188	ARG	3.8
1	C	48	TRP	3.5
1	B	188	ARG	3.5
1	C	288	TYR	3.4
1	A	189	GLU	3.3
1	C	158	ASP	3.3
1	C	3	HIS	3.2
1	C	302	THR	3.0
1	C	242	ALA	3.0
1	B	189	GLU	2.8
1	C	298	ALA	2.8
1	B	3	HIS	2.7
1	C	270	GLY	2.7
1	A	158	ASP	2.7
1	B	158	ASP	2.6
1	C	140	TYR	2.5
1	C	276	GLU	2.5
1	B	288	TYR	2.4
1	B	270	GLY	2.4

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Mol	Chain	Res	Type	RSRZ
1	C	393	GLN	2.4
1	A	302	THR	2.4
1	C	277	GLY	2.4
1	B	405	ASP	2.4
1	C	274	ILE	2.3
1	C	405	ASP	2.3
1	A	-1	SER	2.3
1	C	294	GLU	2.3
1	C	246	ILE	2.3
1	B	2	ASP	2.3
1	B	242	ALA	2.2
1	A	393	GLN	2.2
1	C	279	GLN	2.2
1	B	275	PRO	2.2
1	C	2	ASP	2.2
1	A	132	GLU	2.1
1	B	389	GLU	2.1
1	C	278	THR	2.1
1	B	139	ALA	2.1
1	C	139	ALA	2.1
1	A	288	TYR	2.1
1	C	-1	SER	2.1
1	A	276	GLU	2.1
1	C	266	ALA	2.0
1	A	3	HIS	2.0
1	B	-1	SER	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 ⓘ

There are no carbohydrates in this entry.

## 6.4 Ligands ⓘ

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.