



# Full wwPDB X-ray Structure Validation Report ⓘ

May 22, 2020 – 12:58 am BST

PDB ID : 3PI6  
Title : Crystal structure of the CFTR inhibitory factor Cif with the H177Y mutation  
Authors : Bahl, C.D.; Madden, D.R.  
Deposited on : 2010-11-05  
Resolution : 1.50 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

<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
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

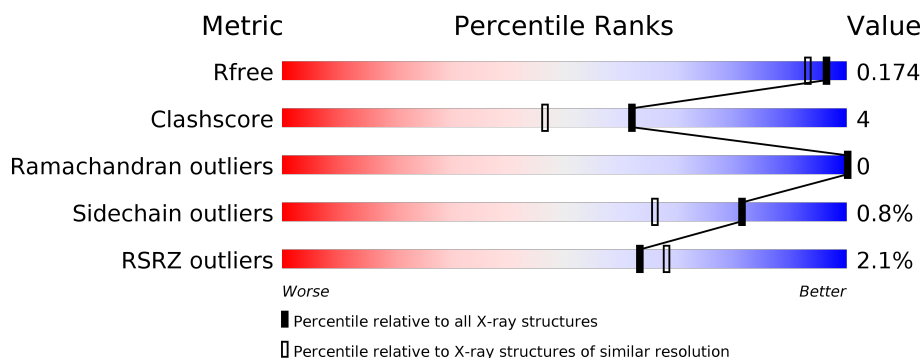
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 1.50 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	2936 (1.50-1.50)
Clashscore	141614	3144 (1.50-1.50)
Ramachandran outliers	138981	3066 (1.50-1.50)
Sidechain outliers	138945	3064 (1.50-1.50)
RSRZ outliers	127900	2884 (1.50-1.50)

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	301	<div> <div>2%</div> <div>91%</div> <div>7%</div> <div>•</div> </div>
1	B	301	<div> <div>2%</div> <div>89%</div> <div>9%</div> <div>•</div> </div>
1	C	301	<div> <div>3%</div> <div>86%</div> <div>11%</div> <div>••</div> </div>
1	D	301	<div> <div>2%</div> <div>93%</div> <div>6%</div> <div>•</div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 10872 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 hydrolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	297	Total	C	N	O	S	7	9	0
			2424	1567	412	434	11			
1	B	296	Total	C	N	O	S	7	5	0
			2392	1545	408	428	11			
1	C	296	Total	C	N	O	S	7	7	0
			2408	1558	409	430	11			
1	D	298	Total	C	N	O	S	7	3	0
			2404	1551	414	428	11			

There are 28 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	177	TYR	HIS	ENGINEERED MUTATION	UNP Q02P97
A	320	HIS	-	EXPRESSION TAG	UNP Q02P97
A	321	HIS	-	EXPRESSION TAG	UNP Q02P97
A	322	HIS	-	EXPRESSION TAG	UNP Q02P97
A	323	HIS	-	EXPRESSION TAG	UNP Q02P97
A	324	HIS	-	EXPRESSION TAG	UNP Q02P97
A	325	HIS	-	EXPRESSION TAG	UNP Q02P97
B	177	TYR	HIS	ENGINEERED MUTATION	UNP Q02P97
B	320	HIS	-	EXPRESSION TAG	UNP Q02P97
B	321	HIS	-	EXPRESSION TAG	UNP Q02P97
B	322	HIS	-	EXPRESSION TAG	UNP Q02P97
B	323	HIS	-	EXPRESSION TAG	UNP Q02P97
B	324	HIS	-	EXPRESSION TAG	UNP Q02P97
B	325	HIS	-	EXPRESSION TAG	UNP Q02P97
C	177	TYR	HIS	ENGINEERED MUTATION	UNP Q02P97
C	320	HIS	-	EXPRESSION TAG	UNP Q02P97
C	321	HIS	-	EXPRESSION TAG	UNP Q02P97
C	322	HIS	-	EXPRESSION TAG	UNP Q02P97
C	323	HIS	-	EXPRESSION TAG	UNP Q02P97
C	324	HIS	-	EXPRESSION TAG	UNP Q02P97
C	325	HIS	-	EXPRESSION TAG	UNP Q02P97

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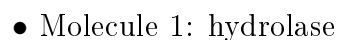
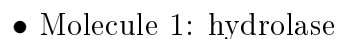
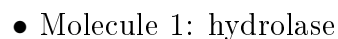
Chain	Residue	Modelled	Actual	Comment	Reference
D	177	TYR	HIS	ENGINEERED MUTATION	UNP Q02P97
D	320	HIS	-	EXPRESSION TAG	UNP Q02P97
D	321	HIS	-	EXPRESSION TAG	UNP Q02P97
D	322	HIS	-	EXPRESSION TAG	UNP Q02P97
D	323	HIS	-	EXPRESSION TAG	UNP Q02P97
D	324	HIS	-	EXPRESSION TAG	UNP Q02P97
D	325	HIS	-	EXPRESSION TAG	UNP Q02P97

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	335	Total 335	O 335	0	0
2	B	290	Total 290	O 290	0	0
2	C	328	Total 328	O 328	0	0
2	D	291	Total 291	O 291	0	0



- Molecule 1: hydrolase



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	168.39 Å   84.06 Å   89.33 Å 90.00°   100.39°   90.00°	Depositor
Resolution (Å)	43.93 – 1.50 43.93 – 1.50	Depositor EDS
% Data completeness (in resolution range)	99.8 (43.93-1.50) 99.8 (43.93-1.50)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.05	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.18 (at 1.50 Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.6.1_357)	Depositor
R, $R_{free}$	0.164   ,   0.181 0.154   ,   0.174	Depositor DCC
$R_{free}$ test set	9754 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	11.6	Xtriage
Anisotropy	0.284	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 47.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	10872	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	14.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.35% 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 [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	0.35	0/2525	0.53	0/3426
1	B	0.32	0/2480	0.52	0/3365
1	C	0.34	0/2505	0.53	0/3398
1	D	0.32	0/2488	0.54	0/3376
All	All	0.33	0/9998	0.53	0/13565

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 [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	2424	0	2357	20	0
1	B	2392	0	2321	20	0
1	C	2408	0	2352	30	0
1	D	2404	0	2324	17	0
2	A	335	0	0	2	0
2	B	290	0	0	3	0
2	C	328	0	0	2	0
2	D	291	0	0	4	0
All	All	10872	0	9354	83	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 (83) 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:212[B]:GLU:HG3	2:C:348:HOH:O	1.70	0.92
1:B:217:ARG:HD2	2:B:787:HOH:O	1.75	0.86
1:C:39:ARG:HG2	1:C:48:TYR:HE1	1.42	0.84
1:C:39:ARG:HG2	1:C:48:TYR:CE1	2.15	0.81
1:A:195[B]:LYS:HE2	1:B:195[B]:LYS:NZ	2.04	0.73
1:B:129:ASP:HA	1:B:154:ALA:HB2	1.72	0.71
1:D:129:ASP:HA	1:D:154:ALA:HB2	1.73	0.69
1:C:129:ASP:HA	1:C:154:ALA:HB2	1.74	0.68
1:B:149:LEU:HB3	1:B:261[B]:THR:HG22	1.76	0.68
1:A:129:ASP:HA	1:A:154:ALA:HB2	1.76	0.67
1:C:195[A]:LYS:HE2	1:D:195[A]:LYS:NZ	2.11	0.65
1:C:195[A]:LYS:HE2	1:D:195[A]:LYS:HZ3	1.61	0.64
1:A:261[A]:THR:HG21	1:A:280:MET:CE	2.29	0.63
1:A:196:GLU:HB3	1:A:226:TYR:CE2	2.35	0.62
1:B:256:ARG:HH21	1:B:285:GLU:HA	1.69	0.57
1:C:261[A]:THR:HG21	1:C:280:MET:CE	2.34	0.57
1:C:186:ARG:HD2	1:C:189[B]:GLU:OE2	2.04	0.56
1:A:62:GLY:HA3	1:A:129:ASP:HB3	1.88	0.55
1:A:261[A]:THR:HG21	1:A:280:MET:HE3	1.88	0.55
1:D:224:ARG:CD	2:D:1210:HOH:O	2.55	0.54
1:C:62:GLY:HA3	1:C:129:ASP:HB3	1.89	0.54
2:A:406:HOH:O	1:C:269:HIS:HD2	1.90	0.54
1:C:261[A]:THR:HG21	1:C:280:MET:HE3	1.89	0.54
1:C:57[A]:VAL:HG22	1:C:124:ASP:HB2	1.89	0.53
1:D:177[A]:TYR:HD2	1:D:181:PHE:CE2	2.27	0.52
1:D:224:ARG:HD2	2:D:1210:HOH:O	2.09	0.52
1:A:269:HIS:HD2	2:C:401:HOH:O	1.92	0.52
1:A:261[A]:THR:HG21	1:A:280:MET:HE2	1.92	0.51
1:B:261[A]:THR:HG21	1:B:280:MET:CE	2.40	0.51
1:B:261[A]:THR:HG21	1:B:280:MET:HE2	1.92	0.51
1:A:57:VAL:HG22	1:A:124:ASP:HB2	1.93	0.51
1:C:196:GLU:HB3	1:C:226:TYR:CE2	2.46	0.51
1:C:288:GLU:OE1	1:C:317:ARG:NH1	2.40	0.50
1:B:57:VAL:HG22	1:B:124:ASP:HB2	1.94	0.50
1:B:259:MET:O	1:B:261[B]:THR:HG23	2.12	0.49
1:B:62:GLY:HA3	1:B:129:ASP:HB3	1.94	0.49
1:D:261:THR:HG21	1:D:280:MET:CE	2.43	0.48
1:D:62:GLY:HA3	1:D:129:ASP:HB3	1.96	0.48
1:D:98:LYS:NZ	2:D:935:HOH:O	2.46	0.48
1:D:177[A]:TYR:CD2	1:D:181:PHE:CE2	3.01	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:177[A]:TYR:HD2	1:A:181:PHE:CE2	2.33	0.47
1:C:259:MET:O	1:C:261[B]:THR:HG23	2.15	0.47
1:D:176:TRP:CZ2	1:D:177[B]:TYR:CE1	3.03	0.46
1:A:176:TRP:CZ2	1:A:177[B]:TYR:CZ	3.04	0.46
1:A:177[A]:TYR:CD2	1:A:181:PHE:CE2	3.03	0.46
1:B:158:ASP:O	1:B:161[A]:ILE:HG12	2.15	0.45
1:C:158:ASP:O	1:C:161:ILE:HG12	2.16	0.45
1:C:38:TYR:O	1:C:39:ARG:HD2	2.16	0.45
1:D:132:ILE:HD12	1:D:154:ALA:HB3	1.97	0.45
1:D:261:THR:HG21	1:D:280:MET:HE2	1.99	0.45
1:B:177[A]:TYR:HD2	1:B:181:PHE:CE2	2.35	0.44
1:B:217:ARG:NH2	2:B:787:HOH:O	2.49	0.44
1:D:224:ARG:HD3	2:D:1210:HOH:O	2.17	0.44
1:C:160:ARG:HG2	1:C:163:ARG:HH22	1.82	0.44
1:A:195[B]:LYS:HE3	1:B:190:THR:O	2.18	0.44
1:A:176:TRP:CZ2	1:A:177[B]:TYR:CE1	3.06	0.44
1:D:272:MET:HE3	1:D:275:PHE:CD1	2.54	0.43
1:A:259:MET:O	1:A:261[B]:THR:HG23	2.18	0.43
1:C:80:ARG:HD3	1:C:320:HIS:CD2	2.53	0.43
1:C:261[A]:THR:HG21	1:C:280:MET:HE2	2.01	0.43
1:B:59:LEU:O	1:B:86:PRO:HD2	2.19	0.43
1:C:160:ARG:HG2	1:C:163:ARG:NH2	2.34	0.43
1:C:210:ASN:HB3	1:C:212:GLU:OE2	2.19	0.43
1:C:189[A]:GLU:HG3	1:C:236:PHE:HD2	1.84	0.42
1:D:176:TRP:CZ2	1:D:177[B]:TYR:CZ	3.08	0.42
1:B:216:GLU:HG2	2:B:1111:HOH:O	2.19	0.42
1:C:140:VAL:HG11	1:C:252:LEU:HB3	2.01	0.42
1:C:177[A]:TYR:HD2	1:C:181:PHE:CE2	2.37	0.42
1:A:189[B]:GLU:OE2	2:A:612:HOH:O	2.22	0.42
1:C:176:TRP:CZ2	1:C:177[B]:TYR:CZ	3.07	0.42
1:C:189[A]:GLU:HG3	1:C:236:PHE:CD2	2.54	0.42
1:D:59:LEU:O	1:D:86:PRO:HD2	2.20	0.42
1:C:129:ASP:HA	1:C:154:ALA:CB	2.48	0.41
1:B:177[A]:TYR:CD2	1:B:181:PHE:CE2	3.08	0.41
1:B:38:TYR:CD1	1:B:45:LYS:HE2	2.56	0.41
1:C:177[A]:TYR:CD2	1:C:181:PHE:CE2	3.09	0.41
1:A:39:ARG:HD2	1:A:116:GLN:OE1	2.20	0.40
1:B:176:TRP:CZ2	1:B:177[B]:TYR:CE1	3.09	0.40
1:C:107:ALA:HB1	1:C:138:MET:HB3	2.03	0.40
1:C:172:GLU:HB2	1:C:176:TRP:NE1	2.36	0.40
1:A:59:LEU:O	1:A:86:PRO:HD2	2.22	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:243:ASN:HA	1:B:243:ASN:HD22	1.75	0.40

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	304/301 (101%)	299 (98%)	5 (2%)	0	100	100
1	B	299/301 (99%)	292 (98%)	7 (2%)	0	100	100
1	C	302/301 (100%)	296 (98%)	6 (2%)	0	100	100
1	D	299/301 (99%)	293 (98%)	6 (2%)	0	100	100
All	All	1204/1204 (100%)	1180 (98%)	24 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	253/248 (102%)	251 (99%)	2 (1%)	81	66
1	B	248/248 (100%)	246 (99%)	2 (1%)	81	66
1	C	251/248 (101%)	249 (99%)	2 (1%)	81	66
1	D	248/248 (100%)	246 (99%)	2 (1%)	81	66

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
All	All	1000/992 (101%)	992 (99%)	8 (1%)	81	66

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	138	MET
1	A	226	TYR
1	B	138	MET
1	B	226	TYR
1	C	138	MET
1	C	226	TYR
1	D	138	MET
1	D	226	TYR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (20) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	53	GLN
1	A	105	GLN
1	A	243	ASN
1	A	269	HIS
1	A	308	ASN
1	B	53	GLN
1	B	105	GLN
1	B	170	GLN
1	B	243	ASN
1	B	308	ASN
1	C	53	GLN
1	C	105	GLN
1	C	243	ASN
1	C	269	HIS
1	C	308	ASN
1	D	105	GLN
1	D	170	GLN
1	D	243	ASN
1	D	308	ASN
1	D	321	HIS

### 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	297/301 (98%)	0.14	5 (1%) 70 75	5, 11, 26, 43	4 (1%)
1	B	296/301 (98%)	0.06	5 (1%) 70 75	6, 12, 30, 46	3 (1%)
1	C	296/301 (98%)	0.21	9 (3%) 50 55	5, 11, 27, 44	3 (1%)
1	D	298/301 (99%)	0.12	6 (2%) 65 70	5, 10, 26, 52	4 (1%)
All	All	1187/1204 (98%)	0.13	25 (2%) 63 68	5, 11, 28, 52	14 (1%)

All (25) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	319	ARG	6.2
1	C	25	ALA	6.0
1	D	319	ARG	5.1
1	D	322	HIS	5.0
1	B	25	ALA	4.7
1	D	321	HIS	4.5
1	C	320	HIS	3.0
1	C	319	ARG	3.0
1	B	317	ARG	2.9
1	A	319	ARG	2.8
1	C	251	GLU	2.7
1	A	255	THR	2.7
1	D	320	HIS	2.7
1	B	320	HIS	2.6
1	B	177[A]	TYR	2.6
1	C	177[A]	TYR	2.4
1	D	177[A]	TYR	2.4
1	C	120	ASP	2.3
1	C	318	GLY	2.3
1	D	285	GLU	2.3
1	A	177[A]	TYR	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	253	ALA	2.2
1	C	255	THR	2.1
1	C	170	GLN	2.1
1	A	321	HIS	2.0

## 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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.