



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 07:41 AM UTC

PDB ID : 2C8E / pdb\_00002c8e  
Title : Structure of the ARTT motif E214N mutant C3bot1 Exoenzyme (Free state, crystal form III)  
Authors : Stura, E.A.; Menetrey, J.; Flatau, G.; Boquet, P.; Menez, A.  
Deposited on : 2005-12-03  
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

<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 : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

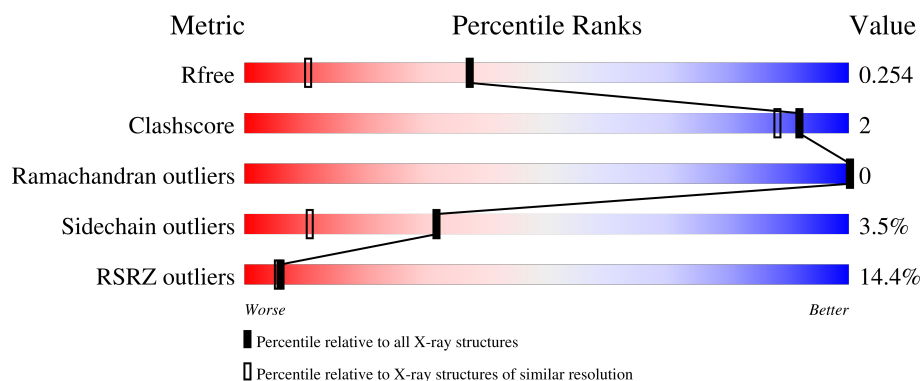
# 1 Overall quality at a glance

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))
$R_{free}$	180053	4673 (1.60-1.60)
Clashscore	190562	4931 (1.60-1.60)
Ramachandran outliers	187476	4831 (1.60-1.60)
Sidechain outliers	187428	4830 (1.60-1.60)
RSRZ outliers	180081	4672 (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 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	E	211	<div> <div>8%</div> <div> <div></div> <div>88%</div> <div>6%</div> <div>5%</div> </div> </div>
1	F	211	<div> <div>10%</div> <div> <div></div> <div>88%</div> <div>6%</div> <div>5%</div> </div> </div>
1	G	211	<div> <div>23%</div> <div> <div></div> <div>90%</div> <div>•</div> <div>7%</div> </div> </div>

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 5358 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 MONO-ADP-RIBOSYLTRANSFERASE C3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	E	200	Total	C	N	O	S	0	4	0
			1583	1006	269	300	8			
1	F	200	Total	C	N	O	S	0	3	0
			1574	997	269	301	7			
1	G	196	Total	C	N	O	S	0	1	0
			1551	989	263	292	7			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	214	ASN	GLU	engineered mutation	UNP P15879
F	214	ASN	GLU	engineered mutation	UNP P15879
G	214	ASN	GLU	engineered mutation	UNP P15879

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	E	1	Total O S 5 4 1	0	0
2	F	1	Total O S 5 4 1	0	0
2	F	1	Total O S 5 4 1	0	0
2	G	1	Total O S 5 4 1	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	E	241	Total O 241 241	0	0
3	F	231	Total O 231 231	0	0
3	G	158	Total O 158 158	0	0

### 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.

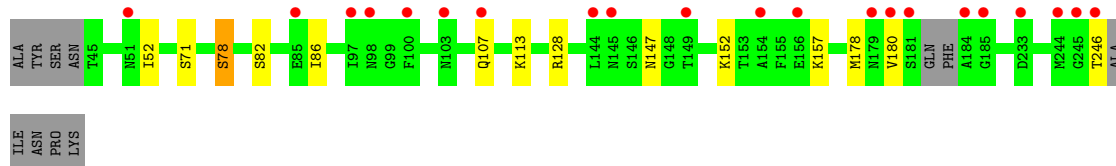
#### • Molecule 1: MONO-ADP-RIBOSYLTRANSFERASE C3

Chain E: 



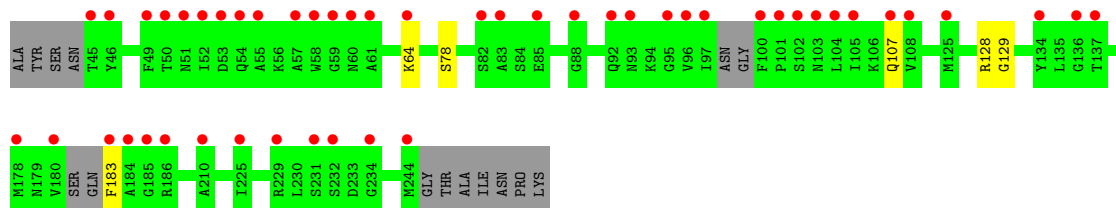
#### • Molecule 1: MONO-ADP-RIBOSYLTRANSFERASE C3

Chain F: 



#### • Molecule 1: MONO-ADP-RIBOSYLTRANSFERASE C3

Chain G: 



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	44.67Å 70.11Å 112.88Å 90.00° 98.63° 90.00°	Depositor
Resolution (Å)	37.27 – 1.60 37.27 – 1.60	Depositor EDS
% Data completeness (in resolution range)	100.0 (37.27-1.60) 96.1 (37.27-1.60)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.81 (at 1.60Å)	Xtriage
Refinement program	REFMAC 5.1.24	Depositor
R, $R_{free}$	0.219 , 0.247 0.227 , 0.254	Depositor DCC
$R_{free}$ test set	4370 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	20.8	Xtriage
Anisotropy	0.208	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.38 , 40.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.021 for h,-k,-h-l	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	5358	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	26.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.75% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4

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	E	0.80	3/1633 (0.2%)	0.76	0/2192
1	F	0.52	0/1615	0.76	0/2167
1	G	0.47	0/1582	0.74	0/2121
All	All	0.62	3/4830 (0.1%)	0.75	0/6480

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	E	125[A]	MET	SD-CE	16.81	2.21	1.79
1	E	125[B]	MET	SD-CE	16.81	2.21	1.79
1	E	243	MET	SD-CE	-5.56	1.65	1.79

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	E	1583	0	1606	9	0
1	F	1574	0	1598	5	0
1	G	1551	0	1577	1	0
2	E	5	0	0	0	0
2	F	10	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	G	5	0	0	0	0
3	E	241	0	0	1	1
3	F	231	0	0	1	0
3	G	158	0	0	0	1
All	All	5358	0	4781	15	1

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 2.

All (15) 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:E:125[A]:MET:SD	1:E:125[A]:MET:CE	2.21	1.29
1:E:125[B]:MET:SD	1:E:125[B]:MET:CE	2.21	1.27
1:E:221:SER:HB3	1:E:243:MET:HE1	1.72	0.69
1:E:113:LYS:NZ	3:E:2104:HOH:O	2.38	0.56
1:F:52:ILE:HG12	1:F:178:MET:HE1	1.88	0.55
1:E:48:GLU:CD	1:E:125[A]:MET:HE2	2.31	0.54
1:F:52:ILE:CG1	1:F:178:MET:HE1	2.38	0.54
1:G:129:GLY:HA3	1:G:183:PHE:HB2	2.00	0.44
1:E:48:GLU:CD	1:E:125[A]:MET:CE	2.90	0.44
1:F:86:ILE:HD11	1:F:107:GLN:HE22	1.84	0.42
1:F:180:VAL:HG21	3:F:2194:HOH:O	2.20	0.42
1:E:224:HIS:HD2	1:E:226:ASP:OD1	2.03	0.41
1:F:78:SER:HB3	1:F:107:GLN:NE2	2.36	0.41
1:E:176[B]:SER:OG	1:E:212:GLN:O	2.39	0.40
1:E:58:TRP:O	1:E:62:GLN:HG2	2.21	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:E:2104:HOH:O	3:G:2023:HOH:O[2_647]	2.16	0.04



## 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	E	202/211 (96%)	198 (98%)	4 (2%)	0	100	100
1	F	199/211 (94%)	197 (99%)	2 (1%)	0	100	100
1	G	191/211 (90%)	189 (99%)	2 (1%)	0	100	100
All	All	592/633 (94%)	584 (99%)	8 (1%)	0	100	100

There are no Ramachandran outliers to report.

### 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	E	175/179 (98%)	169 (97%)	6 (3%)	32	11
1	F	173/179 (97%)	164 (95%)	9 (5%)	21	5
1	G	169/179 (94%)	165 (98%)	4 (2%)	43	19
All	All	517/537 (96%)	498 (96%)	19 (4%)	32	10

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	64	LYS
1	E	65	LYS
1	E	125[A]	MET
1	E	125[B]	MET
1	E	232	SER

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Mol	Chain	Res	Type
1	E	244	MET
1	F	71	SER
1	F	78	SER
1	F	82	SER
1	F	113	LYS
1	F	128	ARG
1	F	147	ASN
1	F	152	LYS
1	F	157	LYS
1	F	246	THR
1	G	64	LYS
1	G	78	SER
1	G	107	GLN
1	G	128	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	E	60	ASN
1	E	140	GLN
1	E	212	GLN
1	E	220	HIS
1	E	224	HIS
1	F	60	ASN
1	F	107	GLN
1	F	147	ASN
1	F	179	ASN
1	G	60	ASN
1	G	214	ASN

### 5.3.3 RNA ⓘ

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 [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

4 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	SO4	F	1248	-	4,4,4	0.23	0	6,6,6	0.10	0
2	SO4	F	1247	-	4,4,4	0.22	0	6,6,6	0.06	0
2	SO4	G	1245	-	4,4,4	0.23	0	6,6,6	0.09	0
2	SO4	E	1245	-	4,4,4	0.24	0	6,6,6	0.08	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

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

### 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	E	200/211 (94%)	0.63	16 (8%)	18 18	14, 22, 29, 32	4 (2%)
1	F	200/211 (94%)	0.88	21 (10%)	11 11	14, 23, 35, 38	3 (1%)
1	G	196/211 (92%)	1.41	49 (25%)	2 1	16, 27, 41, 50	1 (0%)
All	All	596/633 (94%)	0.97	86 (14%)	6 5	14, 24, 37, 50	8 (1%)

All (86) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	180	VAL	6.6
1	F	181	SER	6.3
1	F	180	VAL	5.9
1	G	183	PHE	5.7
1	F	184	ALA	5.4
1	F	85	GLU	5.2
1	F	246	THR	5.0
1	G	184	ALA	5.0
1	F	245	GLY	4.5
1	G	100	PHE	4.3
1	E	103	ASN	4.2
1	F	103	ASN	4.0
1	G	52	ILE	4.0
1	G	107	GLN	4.0
1	G	105	ILE	3.9
1	G	57	ALA	3.8
1	E	183	PHE	3.8
1	G	96	VAL	3.8
1	G	97	ILE	3.6
1	G	50	THR	3.6
1	G	102	SER	3.4
1	F	185	GLY	3.3
1	G	244	MET	3.3

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Mol	Chain	Res	Type	RSRZ
1	G	103	ASN	3.3
1	G	185	GLY	3.2
1	G	229	ARG	3.2
1	E	85	GLU	3.2
1	F	244	MET	3.1
1	E	244	MET	3.1
1	G	45	THR	3.0
1	G	108	VAL	3.0
1	E	209	PHE	3.0
1	G	95	GLY	2.9
1	G	234	GLY	2.9
1	G	54	GLN	2.9
1	E	45	THR	2.9
1	G	61	ALA	2.9
1	G	53	ASP	2.9
1	G	46	TYR	2.8
1	E	181	SER	2.8
1	E	232	SER	2.8
1	F	97	ILE	2.8
1	G	101	PRO	2.8
1	G	85	GLU	2.8
1	G	137	THR	2.8
1	E	182	GLN	2.7
1	G	92	GLN	2.7
1	F	149	THR	2.7
1	G	55	ALA	2.7
1	G	59	GLY	2.6
1	E	84	SER	2.6
1	F	179	ASN	2.6
1	G	49	PHE	2.6
1	G	178	MET	2.6
1	F	51	ASN	2.6
1	F	100	PHE	2.5
1	E	102	SER	2.5
1	F	144	LEU	2.5
1	F	98	ASN	2.5
1	G	51	ASN	2.4
1	G	83	ALA	2.4
1	G	231	SER	2.4
1	G	93	ASN	2.4
1	E	184	ALA	2.3
1	G	210	ALA	2.3

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Mol	Chain	Res	Type	RSRZ
1	G	104	LEU	2.3
1	E	210	ALA	2.3
1	F	156	GLU	2.3
1	G	82	SER	2.3
1	F	154	ALA	2.2
1	G	125	MET	2.2
1	G	186	ARG	2.2
1	G	232	SER	2.2
1	F	233	ASP	2.2
1	G	64	LYS	2.2
1	G	58	TRP	2.2
1	F	107	GLN	2.2
1	E	180	VAL	2.1
1	G	88	GLY	2.1
1	G	134	TYR	2.1
1	G	136	GLY	2.1
1	E	53	ASP	2.1
1	G	60	ASN	2.0
1	F	145	ASN	2.0
1	G	225	ILE	2.0
1	E	146	SER	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 oligosaccharides 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	SO4	F	1248	5/5	0.70	0.22	36,36,36,36	5
2	SO4	E	1245	5/5	0.79	0.21	39,39,40,40	5

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
2	SO4	G	1245	5/5	0.85	0.19	36,36,37,37	5
2	SO4	F	1247	5/5	0.86	0.16	39,39,39,39	5

## 6.5 Other polymers [i](#)

There are no such residues in this entry.