



# Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 7BXX  
Title : Tetanus neurotoxin translocation domain -C467S  
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Deposited on : 2020-04-21  
Resolution : 2.34 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 : 4.02b-467  
Xtrriage (Phenix) : 1.13  
EDS : 2.36  
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) : 2.36

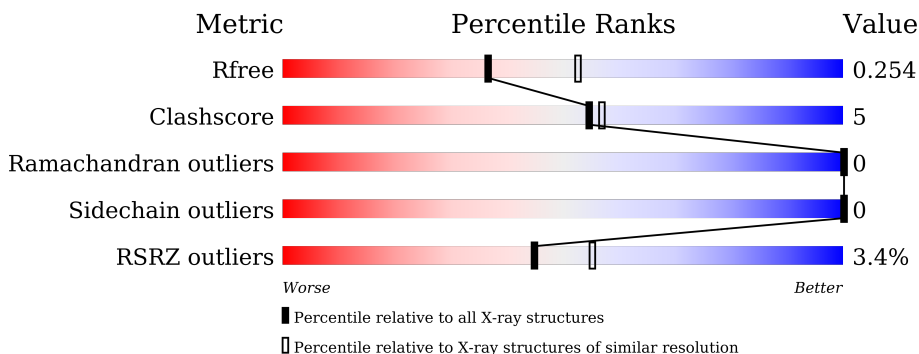
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION, SOLUTION SCATTERING*

The reported resolution of this entry is 2.34 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	2096 (2.36-2.32)
Clashscore	141614	2193 (2.36-2.32)
Ramachandran outliers	138981	2159 (2.36-2.32)
Sidechain outliers	138945	2160 (2.36-2.32)
RSRZ outliers	127900	2067 (2.36-2.32)

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	406	
1	B	406	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4889 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 Tetanus toxin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	301	2447	1578	395	468	6	0	1	0
1	B	291	2361	1523	381	451	6	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	467	SER	CYS	engineered mutation	UNP P04958
B	467	SER	CYS	engineered mutation	UNP P04958

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	66	Total	O	0	1
			67	67		
2	B	14	Total	O	0	0
			14	14		



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	39.60Å 107.12Å 211.41Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.92 – 2.34 38.92 – 2.34	Depositor EDS
% Data completeness (in resolution range)	99.1 (38.92-2.34) 99.1 (38.92-2.34)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.32 (at 2.34Å)	Xtrriage
Refinement program	PHENIX 1.18.2_3874	Depositor
R, $R_{free}$	0.209 , 0.253 0.209 , 0.254	Depositor DCC
$R_{free}$ test set	2000 reflections (5.19%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	58.1	Xtrriage
Anisotropy	0.200	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 50.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	4889	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	77.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.69% 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	0.54	0/2489	0.68	4/3359 (0.1%)
1	B	0.41	0/2401	0.60	0/3238
All	All	0.48	0/4890	0.64	4/6597 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	746	GLU	CA-CB-CG	5.94	126.46	113.40
1	A	565	TYR	CB-CG-CD1	-5.93	117.44	121.00
1	A	617	ARG	NE-CZ-NH1	-5.76	117.42	120.30
1	A	565	TYR	CB-CG-CD2	5.10	124.06	121.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	564	LEU	Peptide

### 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	2447	0	2516	20	0
1	B	2361	0	2428	31	0
2	A	67	0	0	2	0
2	B	14	0	0	0	0
All	All	4889	0	4944	51	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 5.

All (51) 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:770:GLN:H	1:B:770:GLN:CD	1.86	0.79
1:B:700:ILE:HD13	1:B:835:ASN:HB3	1.69	0.75
1:B:620:ILE:HG13	1:B:778:LEU:HD22	1.77	0.66
1:B:612:PHE:HE2	1:B:775:ILE:HD13	1.62	0.64
1:A:576:ILE:HG22	1:A:590:THR:HA	1.82	0.61
1:B:633:ILE:HD13	1:B:666:GLU:HG3	1.83	0.60
1:B:770:GLN:CD	1:B:770:GLN:N	2.56	0.59
1:A:569:SER:H	1:A:747:TYR:HE2	1.50	0.59
1:B:763:TYR:O	1:B:768:LYS:HE3	2.02	0.58
1:B:601:SER:O	1:B:605:GLN:HG3	2.05	0.57
1:B:773:ASP:OD1	1:B:774:GLU:N	2.39	0.55
1:B:767:ASP:HA	1:B:770:GLN:CD	2.27	0.55
1:A:674:LEU:HD21	1:A:734:PHE:CE2	2.44	0.52
1:A:770:GLN:HG3	2:A:939:HOH:O	2.11	0.51
1:A:682:LEU:HD12	1:A:813:ALA:HA	1.92	0.50
1:B:696:GLN:O	1:B:700:ILE:HG13	2.11	0.50
1:A:575:ARG:HG2	2:A:940:HOH:O	2.12	0.49
1:A:694:SER:OG	1:A:696:GLN:HG3	2.13	0.48
1:B:578:MET:HE2	1:B:600:ILE:HA	1.95	0.48
1:B:709:GLU:O	1:B:713:GLU:HG3	2.14	0.47
1:B:766:PRO:HD2	1:B:767:ASP:H	1.79	0.47
1:B:768:LYS:H	1:B:770:GLN:HE22	1.61	0.47
1:B:646:ILE:HD11	1:B:793:ILE:HG12	1.97	0.47
1:B:650:LEU:HD13	1:B:737:ARG:HD2	1.97	0.47
1:A:678:PRO:HG3	1:A:730:VAL:HG22	1.97	0.46
1:A:828:LEU:O	1:A:832:ILE:HG13	2.15	0.46
1:A:723:LYS:HE3	1:A:863:TYR:HD2	1.81	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:675:GLU:OE1	1:B:736:LYS:NZ	2.43	0.46
1:A:687:ALA:HB2	1:A:823:GLN:HB3	1.98	0.45
1:B:761:LYS:HA	1:B:761:LYS:HD2	1.68	0.45
1:A:697:LYS:NZ	1:A:843:GLU:OE1	2.41	0.45
1:B:842:THR:O	1:B:846:LYS:HG3	2.16	0.45
1:A:573:LEU:HD23	1:A:758:TYR:HD1	1.81	0.44
1:B:633:ILE:HG13	1:B:642:ILE:HD13	1.99	0.44
1:A:726:TRP:CD1	1:A:805:LEU:HB2	2.54	0.43
1:A:710:LYS:HA	1:A:710:LYS:HD3	1.84	0.42
1:A:841:ILE:O	1:A:845:LYS:HG3	2.18	0.42
1:B:603:VAL:HG12	1:B:619:ILE:HD13	2.01	0.42
1:A:715:TRP:CG	1:A:859:ILE:HD13	2.55	0.42
1:B:617:ARG:HG2	1:B:778:LEU:HD11	2.01	0.42
1:A:695:THR:HB	1:A:838:PHE:CZ	2.54	0.42
1:B:832:ILE:O	1:B:836:SER:HB3	2.20	0.42
1:B:608:GLN:HG3	1:B:609:GLY:H	1.85	0.41
1:B:616:VAL:O	1:B:620:ILE:HG12	2.19	0.41
1:A:700:ILE:HD13	1:A:835:ASN:HB3	2.02	0.41
1:B:607:ALA:O	1:B:610:ILE:HG12	2.20	0.41
1:B:635:LYS:H	1:B:635:LYS:HG2	1.59	0.41
1:A:576:ILE:HB	1:A:592:ILE:CD1	2.52	0.40
1:B:767:ASP:HA	1:B:770:GLN:NE2	2.35	0.40
1:B:578:MET:CE	1:B:600:ILE:HA	2.51	0.40
1:B:674:LEU:HD23	1:B:674:LEU:HA	1.88	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	300/406 (74%)	290 (97%)	10 (3%)	0	<b>100</b> <b>100</b>

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	289/406 (71%)	278 (96%)	11 (4%)	0	100	100
All	All	589/812 (72%)	568 (96%)	21 (4%)	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	277/374 (74%)	277 (100%)	0	100	100
1	B	267/374 (71%)	267 (100%)	0	100	100
All	All	544/748 (73%)	544 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	608	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 monosaccharides 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	301/406 (74%)	0.25	12 (3%) 38 49	40, 61, 111, 170	0
1	B	291/406 (71%)	0.18	8 (2%) 54 64	60, 84, 132, 164	0
All	All	592/812 (72%)	0.21	20 (3%) 45 55	40, 74, 128, 170	0

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	573	LEU	11.3
1	A	572	THR	8.0
1	A	569	SER	7.3
1	A	565	TYR	7.2
1	A	571	THR	6.0
1	A	570	PRO	5.5
1	A	568	LYS	5.3
1	A	567	GLN	4.8
1	B	775	ILE	4.7
1	B	691	ALA	3.5
1	B	760	TYR	3.1
1	B	676	TYR	3.1
1	B	764	SER	2.9
1	B	838	PHE	2.7
1	A	574	GLN	2.5
1	B	574	GLN	2.3
1	B	754	LYS	2.2
1	A	564	LEU	2.2
1	A	839	ILE	2.1
1	A	847	LEU	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 monosaccharides 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.