



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 28, 2026 – 10:39 PM UTC

PDB ID : 2W2D / pdb\_00002w2d  
Title : Crystal Structure of a Catalytically Active, Non-toxic Endopeptidase Derivative of Clostridium botulinum Toxin A  
Authors : Masuyer, G.; Thiyagarajan, N.; James, P.L.; Marks, P.M.H.; Chaddock, J.A.; Acharya, K.R.  
Deposited on : 2008-10-29  
Resolution : 2.59 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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	:	<b>FAILED</b>
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

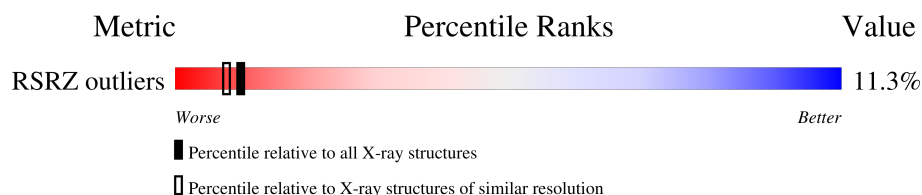
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.59 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))
RSRZ outliers	180081	4008 (2.60-2.60)

MolProbity failed to run properly - the sequence quality summary graphics cannot be shown.

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
6	GOL	A	1436	-	X	-	-
6	GOL	A	1437	-	X	-	-
6	GOL	A	1438	-	X	-	-
6	GOL	B	1873	-	X	-	-
6	GOL	B	1874	-	X	-	-

## 2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 14160 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 BOTULINUM NEUROTOXIN A LIGHT CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	437	Total	C	N	O	S	0	0	1
			3534	2281	574	669	10			
1	C	436	Total	C	N	O	S	0	0	1
			3522	2273	573	666	10			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	2	GLU	PRO	conflict	UNP A5HZZ9
A	432	ASP	ARG	conflict	UNP A5HZZ9
C	2	GLU	PRO	conflict	UNP A5HZZ9
C	432	ASP	ARG	conflict	UNP A5HZZ9

- Molecule 2 is a protein called BOTULINUM NEUROTOXIN A HEAVY CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	424	Total	C	N	O	S	0	0	1
			3429	2195	550	674	10			
2	D	408	Total	C	N	O	S	0	0	1
			3308	2119	529	650	10			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	452	LEU	ASP	conflict	UNP A5HZZ9
B	453	GLN	LEU	conflict	UNP A5HZZ9
D	452	LEU	ASP	conflict	UNP A5HZZ9
D	453	GLN	LEU	conflict	UNP A5HZZ9

- Molecule 3 is SULFATE ION (CCD ID: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		
3	C	1	Total	O	S	0	0
			5	4	1		
3	C	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Zn	0	0
			1	1		
4	C	1	Total	Zn	0	0
			1	1		

- Molecule 5 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

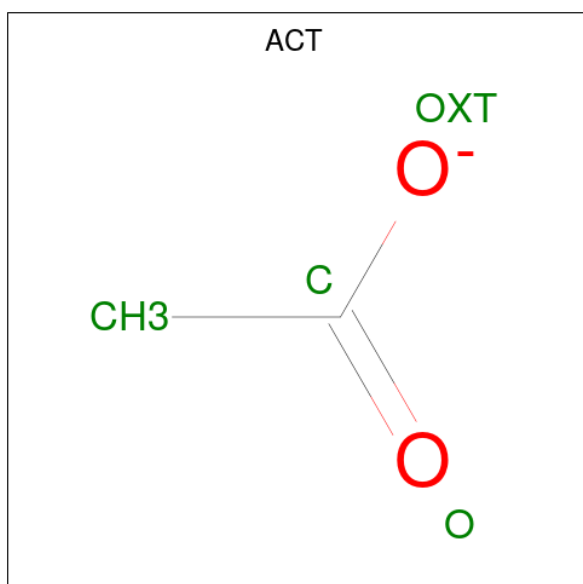
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	2	Total	Cl	0	0
			2	2		
5	D	1	Total	Cl	0	0
			1	1		

- Molecule 6 is GLYCEROL (CCD ID: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			6	3	3		
6	A	1	Total	C	O	0	0
			6	3	3		
6	A	1	Total	C	O	0	0
			6	3	3		
6	B	1	Total	C	O	0	0
			6	3	3		
6	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 7 is ACETATE ION (CCD ID: ACT) (formula:  $C_2H_3O_2$ ).



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

- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	110	Total	O	0	0
			110	110		
8	B	49	Total	O	0	0
			49	49		
8	C	118	Total	O	0	0
			118	118		
8	D	31	Total	O	0	0
			31	31		

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### 3 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	78.36Å 156.91Å 211.65Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.11 – 2.59 49.11 – 2.59	Depositor EDS
% Data completeness (in resolution range)	91.2 (49.11-2.59) 91.1 (49.11-2.59)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.82 (at 2.58Å)	Xtriage
Refinement program	CNS 1.2	Depositor
R, $R_{free}$	0.212 , 0.253 0.214 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	34.3	Xtriage
Anisotropy	0.240	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.38 , 61.6	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	0.92	EDS
Total number of atoms	14160	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.61% 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.

## 4 Model quality [i](#)

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

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### 4.2 Too-close contacts [i](#)

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### 4.3 Torsion angles [i](#)

#### 4.3.1 Protein backbone [i](#)

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#### 4.3.2 Protein sidechains [i](#)

MolProbity failed to run properly - this section is therefore empty.

#### 4.3.3 RNA [i](#)

MolProbity failed to run properly - this section is therefore empty.

### 4.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

### 4.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

### 4.6 Ligand geometry [i](#)

Of 15 ligands modelled in this entry, 5 are monoatomic - leaving 10 for Mogul analysis.

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
3	SO4	B	1872	-	4,4,4	0.38	0	6,6,6	0.10	0
6	GOL	A	1437	-	5,5,5	4.72	5 (100%)	5,5,5	6.15	3 (60%)
3	SO4	C	1437	-	4,4,4	0.36	0	6,6,6	0.07	0
6	GOL	B	1873	-	5,5,5	4.72	5 (100%)	5,5,5	6.12	3 (60%)
3	SO4	C	1436	-	4,4,4	0.41	0	6,6,6	0.06	0
6	GOL	B	1874	-	5,5,5	4.79	5 (100%)	5,5,5	6.11	3 (60%)
3	SO4	A	1433	-	4,4,4	0.41	0	6,6,6	0.11	0
7	ACT	C	1435	-	3,3,3	1.03	0	3,3,3	0.83	0
6	GOL	A	1436	-	5,5,5	4.81	5 (100%)	5,5,5	6.15	3 (60%)
6	GOL	A	1438	-	5,5,5	4.81	5 (100%)	5,5,5	6.09	3 (60%)

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
6	GOL	A	1437	-	-	2/4/4/4	-
6	GOL	B	1873	-	-	2/4/4/4	-
6	GOL	B	1874	-	-	2/4/4/4	-
6	GOL	A	1436	-	-	3/4/4/4	-
6	GOL	A	1438	-	-	2/4/4/4	-

The worst 5 of 25 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	1438	GOL	C3-C2	-8.09	1.20	1.51
6	B	1873	GOL	C3-C2	-8.08	1.21	1.51
6	B	1874	GOL	C3-C2	-8.04	1.21	1.51
6	A	1436	GOL	C3-C2	-8.01	1.21	1.51
6	A	1437	GOL	C3-C2	-7.97	1.21	1.51

The worst 5 of 15 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	1437	GOL	O3-C3-C2	11.25	161.04	110.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	1436	GOL	O3-C3-C2	11.24	160.97	110.38
6	B	1873	GOL	O3-C3-C2	11.12	160.43	110.38
6	A	1438	GOL	O3-C3-C2	11.02	160.00	110.38
6	B	1874	GOL	O3-C3-C2	11.00	159.91	110.38

There are no chirality outliers.

5 of 11 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	1436	GOL	O1-C1-C2-C3
6	A	1436	GOL	C1-C2-C3-O3
6	A	1437	GOL	C1-C2-C3-O3
6	A	1438	GOL	O1-C1-C2-C3
6	A	1438	GOL	C1-C2-C3-O3

There are no ring outliers.

No monomer is involved in short contacts.

## 4.7 Other polymers [i](#)

There are no such residues in this entry.

## 4.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 5 Fit of model and data [i](#)

### 5.1 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	437/450 (97%)	-0.04	20 (4%) 37 32	12, 27, 54, 98	0
1	C	436/450 (96%)	0.02	19 (4%) 39 33	12, 30, 59, 75	0
2	B	424/431 (98%)	0.67	51 (12%) 9 7	20, 42, 78, 93	0
2	D	408/431 (94%)	1.31	103 (25%) 1 1	21, 48, 101, 117	0
All	All	1705/1762 (96%)	0.48	193 (11%) 10 8	12, 36, 78, 117	0

The worst 5 of 193 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	606	TRP	9.5
2	D	607	VAL	7.8
2	D	601	ALA	7.8
2	D	603	PHE	7.8
2	B	566	ILE	7.4

### 5.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

### 5.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

### 5.4 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
6	GOL	B	1873	6/6	0.77	0.19	51,53,55,56	0
3	SO4	C	1436	5/5	0.81	0.19	82,83,85,85	0
6	GOL	A	1438	6/6	0.87	0.16	54,55,56,58	0
6	GOL	A	1436	6/6	0.87	0.15	54,55,56,58	0
7	ACT	C	1435	4/4	0.88	0.14	49,50,51,52	0
3	SO4	A	1433	5/5	0.89	0.14	68,69,70,72	0
3	SO4	C	1437	5/5	0.89	0.12	69,69,70,70	0
6	GOL	B	1874	6/6	0.92	0.13	55,59,59,60	0
6	GOL	A	1437	6/6	0.93	0.14	44,46,47,49	0
3	SO4	B	1872	5/5	0.94	0.09	47,48,50,51	0
5	CL	A	1435	1/1	0.97	0.08	44,44,44,44	0
5	CL	A	1439	1/1	0.97	0.12	44,44,44,44	0
5	CL	D	1872	1/1	0.97	0.15	47,47,47,47	0
4	ZN	C	1438	1/1	1.00	0.04	29,29,29,29	0
4	ZN	A	1434	1/1	1.00	0.02	23,23,23,23	0

## 5.5 Other polymers [i](#)

There are no such residues in this entry.