



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 16, 2020 – 01:49 am BST

PDB ID : 5TSP  
Title : Crystal structure of the catalytic domain of Clostridium perfringens neuraminidase (NanI) in complex with a CHES  
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Deposited on : 2016-10-31  
Resolution : 1.24 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.

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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	:	1.8.5 (274361), CSD as541be (2020)
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

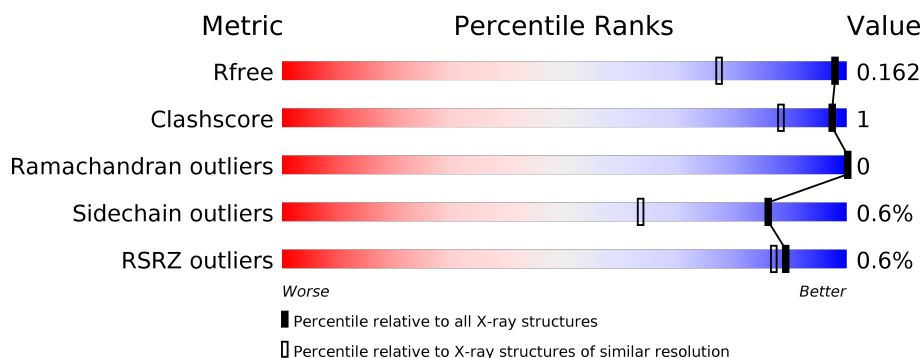
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.24 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	2024 (1.28-1.20)
Clashscore	141614	1007 (1.26-1.22)
Ramachandran outliers	138981	2053 (1.28-1.20)
Sidechain outliers	138945	2051 (1.28-1.20)
RSRZ outliers	127900	1987 (1.28-1.20)

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	461	<div> <div>%</div> <div> <div></div> <div>94%</div> <div></div> </div> <div></div> </div>
1	B	461	<div> <div></div> <div>95%</div> <div></div> </div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 9095 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.

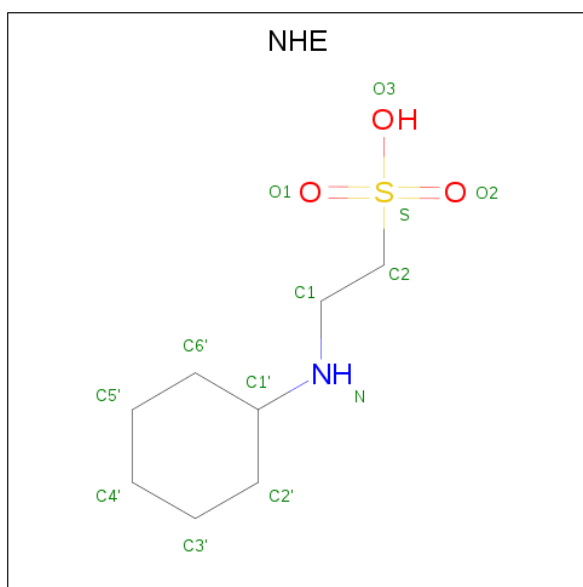
- Molecule 1 is a protein called Sialidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	448	Total	C	N	O	S	0	12	0
			3620	2271	608	730	11			
1	B	448	Total	C	N	O	S	0	11	0
			3615	2269	608	727	11			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	242	MET	-	expression tag	UNP A0A0H2YQR1
A	695	LEU	-	expression tag	UNP A0A0H2YQR1
A	696	GLU	-	expression tag	UNP A0A0H2YQR1
A	697	HIS	-	expression tag	UNP A0A0H2YQR1
A	698	HIS	-	expression tag	UNP A0A0H2YQR1
A	699	HIS	-	expression tag	UNP A0A0H2YQR1
A	700	HIS	-	expression tag	UNP A0A0H2YQR1
A	701	HIS	-	expression tag	UNP A0A0H2YQR1
A	702	HIS	-	expression tag	UNP A0A0H2YQR1
B	242	MET	-	expression tag	UNP A0A0H2YQR1
B	695	LEU	-	expression tag	UNP A0A0H2YQR1
B	696	GLU	-	expression tag	UNP A0A0H2YQR1
B	697	HIS	-	expression tag	UNP A0A0H2YQR1
B	698	HIS	-	expression tag	UNP A0A0H2YQR1
B	699	HIS	-	expression tag	UNP A0A0H2YQR1
B	700	HIS	-	expression tag	UNP A0A0H2YQR1
B	701	HIS	-	expression tag	UNP A0A0H2YQR1
B	702	HIS	-	expression tag	UNP A0A0H2YQR1

- Molecule 2 is 2-[N-CYCLOHEXYLAMINO]ETHANE SULFONIC ACID (three-letter code: NHE) (formula: C<sub>8</sub>H<sub>17</sub>NO<sub>3</sub>S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	S	0	0
			13	8	1	3	1		
2	B	1	Total	C	N	O	S	0	0
			13	8	1	3	1		

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	Ca	0	0
			1	1		
3	A	1	Total	Ca	0	0
			1	1		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	887	Total	O	0	0
			887	887		
4	B	945	Total	O	0	0
			945	945		

### 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 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: Sialidase

Chain A:  94%



#### ● Molecule 1: Sialidase

Chain B:  95%



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	69.39Å 98.01Å 72.65Å 90.00° 90.99° 90.00°	Depositor
Resolution (Å)	35.20 – 1.24 35.20 – 1.24	Depositor EDS
% Data completeness (in resolution range)	99.3 (35.20-1.24) 99.3 (35.20-1.24)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.99 (at 1.24Å)	Xtriage
Refinement program	PHENIX 1.8_1069	Depositor
R, $R_{free}$	0.144 , 0.158 0.148 , 0.162	Depositor DCC
$R_{free}$ test set	13756 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	8.4	Xtriage
Anisotropy	0.040	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 39.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.000 for l,k,-h 0.017 for h,-k,-l 0.011 for l,-k,h	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	9095	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	13.0	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: NHE, CA

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	0.36	0/3693	0.60	2/4998 (0.0%)
1	B	0.34	0/3688	0.60	3/4991 (0.1%)
All	All	0.35	0/7381	0.60	5/9989 (0.1%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	408	ARG	NE-CZ-NH1	6.11	123.36	120.30
1	A	283	ASP	CB-CG-OD1	5.89	123.60	118.30
1	B	283	ASP	CB-CG-OD2	-5.53	113.32	118.30
1	B	283	ASP	CB-CG-OD1	5.46	123.22	118.30
1	A	283	ASP	CB-CG-OD2	-5.15	113.67	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	3620	0	3491	8	0
1	B	3615	0	3491	4	0
2	A	13	0	17	0	0
2	B	13	0	17	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	887	0	0	6	0
4	B	945	0	0	2	0
All	All	9095	0	7016	12	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 1.

The worst 5 of 12 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:372[A]:CYS:SG	1:B:380:GLU:HG3	2.33	0.69
1:A:243:VAL:N	4:A:1108:HOH:O	2.34	0.61
1:A:329:THR:HG22	1:A:344[B]:VAL:HG22	1.84	0.59
1:A:447:GLN:NE2	4:A:1114:HOH:O	2.41	0.53
1:B:676:GLU:HG3	4:B:1605:HOH:O	2.14	0.48

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	458/461 (99%)	440 (96%)	18 (4%)	0	100	100
1	B	457/461 (99%)	442 (97%)	15 (3%)	0	100	100
All	All	915/922 (99%)	882 (96%)	33 (4%)	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	A	399/398 (100%)	396 (99%)	3 (1%)	81	55
1	B	398/398 (100%)	396 (100%)	2 (0%)	88	68
All	All	797/796 (100%)	792 (99%)	5 (1%)	86	63

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	326	VAL
1	A	450	ASN
1	A	585	GLU
1	B	450	ASN
1	B	585	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	315	GLN
1	B	582	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 ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 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	$\# Z  > 2$
2	NHE	A	1001	-	13,13,13	0.93	0	16,17,17	0.98	1 (6%)
2	NHE	B	1001	-	13,13,13	0.88	0	16,17,17	1.07	2 (12%)

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
2	NHE	A	1001	-	-	0/7/15/15	0/1/1/1
2	NHE	B	1001	-	-	0/7/15/15	0/1/1/1

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1001	NHE	O1-S-C2	2.91	110.42	106.92
2	A	1001	NHE	O1-S-C2	2.35	109.75	106.92
2	B	1001	NHE	O2-S-C2	-2.03	104.47	106.92

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

There are no such residues in this entry.

## 5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

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

### 6.1 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	448/461 (97%)	-0.28	3 (0%) 87 84	5, 9, 18, 36	0
1	B	448/461 (97%)	-0.34	2 (0%) 92 89	5, 8, 17, 32	0
All	All	896/922 (97%)	-0.31	5 (0%) 89 87	5, 9, 18, 36	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	243	VAL	9.6
1	B	243	VAL	5.9
1	B	244	GLU	2.5
1	A	392	ASP	2.3
1	A	244	GLU	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](#)

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	NHE	B	1001	13/13	0.98	0.08	8,9,10,10	0
2	NHE	A	1001	13/13	0.99	0.05	7,7,10,10	0
3	CA	B	1002	1/1	1.00	0.03	6,6,6,6	0
3	CA	A	1002	1/1	1.00	0.03	6,6,6,6	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.