



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 25, 2025 – 10:07 AM EDT

PDB ID : 9NG7  
Title : cis-CaaD H28A mutant  
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Deposited on : 2025-02-21  
Resolution : 1.80 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  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 1.21  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.004 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.41.4

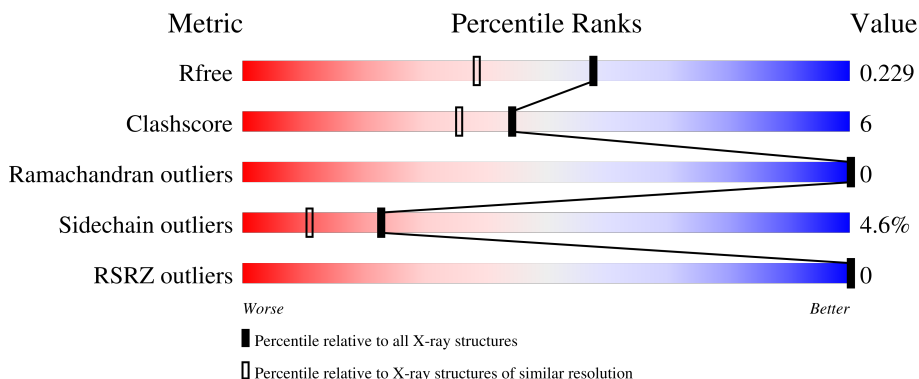
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.80 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))
$R_{free}$	164625	7108 (1.80-1.80)
Clashscore	180529	8162 (1.80-1.80)
Ramachandran outliers	177936	8077 (1.80-1.80)
Sidechain outliers	177891	8076 (1.80-1.80)
RSRZ outliers	164620	7108 (1.80-1.80)

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	164	
1	B	164	
1	C	164	

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
2	ACT	B	201	-	-	X	-

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2962 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 Cis-3-chloroacrylic acid dehalogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	120	Total	C	N	O	S	0	0	0
			933	591	169	170	3			
1	B	120	Total	C	N	O	S	0	0	0
			933	591	169	170	3			
1	C	120	Total	C	N	O	S	0	0	0
			933	591	169	170	3			

There are 48 discrepancies between the modelled and reference sequences:

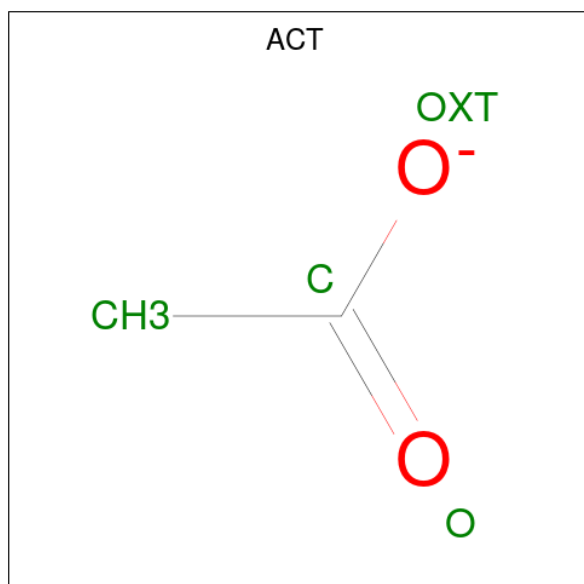
Chain	Residue	Modelled	Actual	Comment	Reference
A	28	ALA	HIS	engineered mutation	UNP Q6VPE5
A	150	GLU	-	expression tag	UNP Q6VPE5
A	151	ASN	-	expression tag	UNP Q6VPE5
A	152	LEU	-	expression tag	UNP Q6VPE5
A	153	TYR	-	expression tag	UNP Q6VPE5
A	154	PHE	-	expression tag	UNP Q6VPE5
A	155	GLN	-	expression tag	UNP Q6VPE5
A	156	GLY	-	expression tag	UNP Q6VPE5
A	157	LEU	-	expression tag	UNP Q6VPE5
A	158	GLU	-	expression tag	UNP Q6VPE5
A	159	HIS	-	expression tag	UNP Q6VPE5
A	160	HIS	-	expression tag	UNP Q6VPE5
A	161	HIS	-	expression tag	UNP Q6VPE5
A	162	HIS	-	expression tag	UNP Q6VPE5
A	163	HIS	-	expression tag	UNP Q6VPE5
A	164	HIS	-	expression tag	UNP Q6VPE5
B	28	ALA	HIS	engineered mutation	UNP Q6VPE5
B	150	GLU	-	expression tag	UNP Q6VPE5
B	151	ASN	-	expression tag	UNP Q6VPE5
B	152	LEU	-	expression tag	UNP Q6VPE5
B	153	TYR	-	expression tag	UNP Q6VPE5
B	154	PHE	-	expression tag	UNP Q6VPE5
B	155	GLN	-	expression tag	UNP Q6VPE5

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Chain	Residue	Modelled	Actual	Comment	Reference
B	156	GLY	-	expression tag	UNP Q6VPE5
B	157	LEU	-	expression tag	UNP Q6VPE5
B	158	GLU	-	expression tag	UNP Q6VPE5
B	159	HIS	-	expression tag	UNP Q6VPE5
B	160	HIS	-	expression tag	UNP Q6VPE5
B	161	HIS	-	expression tag	UNP Q6VPE5
B	162	HIS	-	expression tag	UNP Q6VPE5
B	163	HIS	-	expression tag	UNP Q6VPE5
B	164	HIS	-	expression tag	UNP Q6VPE5
C	28	ALA	HIS	engineered mutation	UNP Q6VPE5
C	150	GLU	-	expression tag	UNP Q6VPE5
C	151	ASN	-	expression tag	UNP Q6VPE5
C	152	LEU	-	expression tag	UNP Q6VPE5
C	153	TYR	-	expression tag	UNP Q6VPE5
C	154	PHE	-	expression tag	UNP Q6VPE5
C	155	GLN	-	expression tag	UNP Q6VPE5
C	156	GLY	-	expression tag	UNP Q6VPE5
C	157	LEU	-	expression tag	UNP Q6VPE5
C	158	GLU	-	expression tag	UNP Q6VPE5
C	159	HIS	-	expression tag	UNP Q6VPE5
C	160	HIS	-	expression tag	UNP Q6VPE5
C	161	HIS	-	expression tag	UNP Q6VPE5
C	162	HIS	-	expression tag	UNP Q6VPE5
C	163	HIS	-	expression tag	UNP Q6VPE5
C	164	HIS	-	expression tag	UNP Q6VPE5

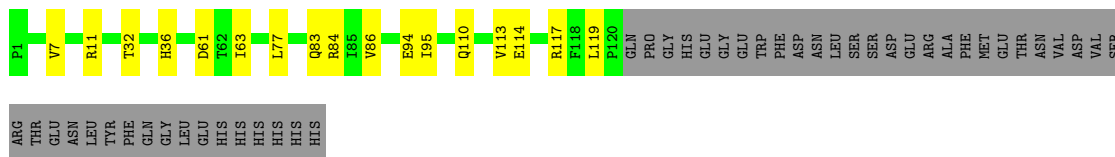
- Molecule 2 is ACETATE ION (three-letter code: ACT) (formula:  $C_2H_3O_2$ ).



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

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	50	Total	O	0	0
			50	50		
3	B	54	Total	O	0	0
			54	54		
3	C	51	Total	O	0	0
			51	51		



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	50.55Å 87.68Å 153.96Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	28.92 – 1.80 28.92 – 1.80	Depositor EDS
% Data completeness (in resolution range)	76.2 (28.92-1.80) 98.3 (28.92-1.80)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.74 (at 1.79Å)	Xtriage
Refinement program	PHENIX 1.21.2_5419	Depositor
R, $R_{free}$	0.190 , 0.231 0.191 , 0.229	Depositor DCC
$R_{free}$ test set	29726 reflections (6.32%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	19.1	Xtriage
Anisotropy	0.065	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.39 , 34.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.480 for 1/2*h-1/2*k,-3/2*h-1/2*k,-l 0.480 for 1/2*h+1/2*k,3/2*h-1/2*k,-l	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	2962	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.90% 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: ACT

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	0.39	0/954	0.62	0/1291
1	B	0.37	0/954	0.63	0/1291
1	C	0.37	0/954	0.60	0/1291
All	All	0.38	0/2862	0.62	0/3873

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	933	0	916	8	0
1	B	933	0	916	17	0
1	C	933	0	916	9	0
2	B	4	0	3	5	0
2	C	4	0	3	1	0
3	A	50	0	0	0	0
3	B	54	0	0	3	0
3	C	51	0	0	2	0
All	All	2962	0	2754	33	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 6.

All (33) 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)
2:B:201:ACT:H3	3:B:302:HOH:O	1.64	0.96
1:B:29:ARG:HG3	1:B:34:THR:O	1.65	0.96
1:B:1:PRO:H3	2:B:201:ACT:H2	1.35	0.88
1:B:1:PRO:HA	3:B:302:HOH:O	1.73	0.87
1:B:32:THR:OG1	1:B:34:THR:HG22	1.78	0.84
1:C:32:THR:HG22	1:C:77:LEU:HD21	1.61	0.81
1:A:61:ASP:O	1:A:95:ILE:HD11	1.93	0.68
1:B:73:ARG:NE	1:B:77:LEU:HD23	2.09	0.67
1:B:61:ASP:O	1:B:95:ILE:HD11	2.02	0.59
1:B:1:PRO:N	2:B:201:ACT:H2	2.14	0.59
2:C:201:ACT:H3	3:C:339:HOH:O	2.07	0.55
1:B:1:PRO:HB3	2:B:201:ACT:O	2.08	0.53
1:B:32:THR:HG22	1:B:77:LEU:HD21	1.90	0.52
1:B:73:ARG:HE	1:B:77:LEU:HD23	1.75	0.51
1:C:114:GLU:HG3	1:C:119:LEU:HD21	1.93	0.50
1:C:7:VAL:HG12	1:C:63:ILE:HG12	1.94	0.49
1:B:29:ARG:CZ	1:B:35:GLN:HA	2.42	0.49
1:A:86:VAL:HG21	1:C:113:VAL:HG11	1.94	0.48
1:C:32:THR:HG23	3:C:302:HOH:O	2.13	0.48
1:A:3:TYR:OH	1:A:69:HIS:HE1	1.97	0.48
1:C:11:ARG:NH2	1:C:95:ILE:HG12	2.30	0.47
1:A:114:GLU:HG3	1:A:119:LEU:HD11	1.96	0.46
1:A:28:ALA:HB1	1:A:34:THR:HG21	1.98	0.46
1:B:113:VAL:HG11	1:C:86:VAL:HG21	1.98	0.46
1:B:118:PHE:CE2	1:C:83:GLN:HG2	2.51	0.45
1:A:113:VAL:HG11	1:B:86:VAL:HG21	1.99	0.45
1:B:73:ARG:NE	1:B:73:ARG:HA	2.33	0.43
1:A:73:ARG:HD2	1:A:77:LEU:HD23	2.01	0.43
1:B:84:ARG:HH11	1:B:84:ARG:HG3	1.85	0.42
1:C:114:GLU:CG	1:C:119:LEU:HD21	2.49	0.42
2:B:201:ACT:CH3	3:B:302:HOH:O	2.43	0.41
1:B:31:LEU:HB3	1:B:77:LEU:HD11	2.01	0.41
1:A:93:ALA:HB3	1:A:95:ILE:HG22	2.03	0.40

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	118/164 (72%)	116 (98%)	2 (2%)	0	100	100
1	B	118/164 (72%)	117 (99%)	1 (1%)	0	100	100
1	C	118/164 (72%)	117 (99%)	1 (1%)	0	100	100
All	All	354/492 (72%)	350 (99%)	4 (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	A	95/135 (70%)	91 (96%)	4 (4%)	25	13
1	B	95/135 (70%)	92 (97%)	3 (3%)	34	22
1	C	95/135 (70%)	89 (94%)	6 (6%)	15	5
All	All	285/405 (70%)	272 (95%)	13 (5%)	23	11

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	34	THR
1	A	35	GLN
1	A	36	HIS
1	A	70	ARG
1	B	34	THR

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Mol	Chain	Res	Type
1	B	36	HIS
1	B	61	ASP
1	C	36	HIS
1	C	61	ASP
1	C	84	ARG
1	C	94	GLU
1	C	110	GLN
1	C	117	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	69	HIS
1	A	83	GLN
1	B	36	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 oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

2 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	ACT	B	201	-	3,3,3	1.09	0	3,3,3	0.44	0
2	ACT	C	201	-	3,3,3	0.99	0	3,3,3	0.58	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.

2 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	201	ACT	5	0
2	C	201	ACT	1	0

## 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 [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	120/164 (73%)	-1.19	0 100 100	10, 21, 49, 61	0
1	B	120/164 (73%)	-1.20	0 100 100	10, 21, 50, 60	0
1	C	120/164 (73%)	-1.21	0 100 100	9, 21, 49, 60	0
All	All	360/492 (73%)	-1.20	0 100 100	9, 21, 49, 61	0

There are no RSRZ outliers to report.

### 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](#)

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(Å <sup>2</sup> )	Q<0.9
2	ACT	C	201	4/4	0.97	0.07	37,37,40,47	0
2	ACT	B	201	4/4	0.98	0.06	33,36,44,46	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.