



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 04:52 PM UTC

PDB ID : 4PWS / pdb_00004pws
Title : Crystal structure of secreted proline rich antigen MTC28 (Rv0040c) at 2.15 Å with bound chloride from Mycobacterium tuberculosis
Authors : Kundu, P.; Biswas, R.; Mukherjee, S.; Reinhard, L.; Mueller-dieckmann, J.; Weiss, M.S.; Das, A.K.
Deposited on : 2014-03-21
Resolution : 2.15 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

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>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
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

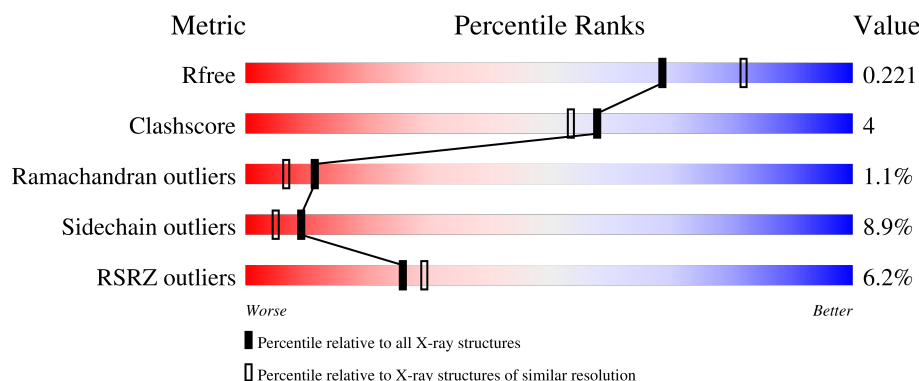
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.15 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	2057 (2.16-2.16)
Clashscore	190562	2159 (2.16-2.16)
Ramachandran outliers	187476	2134 (2.16-2.16)
Sidechain outliers	187428	2133 (2.16-2.16)
RSRZ outliers	180081	2059 (2.16-2.16)

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 ≥ 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	289	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 1389 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 Proline-rich 28 kDa antigen.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	176	Total	C	N	O	S	0	0	0
			1341	847	232	259	3			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	22	HIS	-	expression tag	UNP P0A5Q6
A	23	HIS	-	expression tag	UNP P0A5Q6
A	24	HIS	-	expression tag	UNP P0A5Q6
A	25	HIS	-	expression tag	UNP P0A5Q6
A	26	HIS	-	expression tag	UNP P0A5Q6
A	27	HIS	-	expression tag	UNP P0A5Q6
A	28	GLY	-	expression tag	UNP P0A5Q6
A	29	SER	-	expression tag	UNP P0A5Q6
A	30	ALA	-	expression tag	UNP P0A5Q6
A	31	CYS	-	expression tag	UNP P0A5Q6

- Molecule 2 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

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

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	47	Total	O	0	0
			47	47		

- Molecule 1: Proline-rich 28 kDa antigen



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	101.41Å 101.41Å 67.69Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	43.95 – 2.15 43.95 – 2.15	Depositor EDS
% Data completeness (in resolution range)	99.8 (43.95-2.15) 99.8 (43.95-2.15)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.02 (at 2.16Å)	Xtriage
Refinement program	REFMAC 5.7.0029	Depositor
R, R_{free}	0.189 , 0.215 0.196 , 0.221	Depositor DCC
R_{free} test set	1132 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å ²)	36.4	Xtriage
Anisotropy	0.045	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 37.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.036 for -h,-k,l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	1389	wwPDB-VP
Average B, all atoms (Å ²)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.71% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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

5.1 Standard geometry

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

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	1.71	18/1371 (1.3%)	1.48	18/1875 (1.0%)

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	262	ASP	CB-CG	-11.17	1.24	1.52
1	A	134	MET	C-O	-7.80	1.17	1.25
1	A	123	HIS	N-CA	6.41	1.53	1.46
1	A	181	GLU	N-CA	-6.34	1.38	1.46
1	A	149	ALA	C-O	-6.29	1.16	1.23
1	A	202	SER	N-CA	-6.20	1.38	1.46
1	A	141	VAL	N-CA	-5.99	1.42	1.46
1	A	198	THR	CA-C	-5.82	1.45	1.52
1	A	205	ASN	C-O	-5.57	1.17	1.23
1	A	217	THR	CA-C	-5.45	1.46	1.52
1	A	230	ARG	CZ-NH2	-5.41	1.26	1.33
1	A	249	THR	CB-CG2	-5.36	1.34	1.52
1	A	214	ILE	N-CA	-5.29	1.40	1.46
1	A	146	VAL	C-O	5.26	1.31	1.24
1	A	121	ARG	CA-CB	-5.26	1.47	1.54
1	A	247	VAL	C-O	-5.21	1.18	1.24
1	A	110	LEU	C-O	-5.10	1.18	1.24
1	A	121	ARG	CA-C	-5.01	1.47	1.52

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	105	THR	N-CA-CB	-9.02	97.36	110.26
1	A	262	ASP	OD1-CG-OD2	7.63	141.21	122.90
1	A	262	ASP	N-CA-CB	-7.05	99.73	110.16

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	262	ASP	CB-CA-C	-6.51	99.79	110.85
1	A	141	VAL	N-CA-C	-6.33	101.28	107.55
1	A	150	PHE	N-CA-C	-6.23	104.40	112.68
1	A	249	THR	N-CA-CB	-6.10	101.47	111.66
1	A	144	PRO	N-CA-C	5.97	121.40	113.57
1	A	101	ALA	N-CA-C	-5.96	102.84	110.53
1	A	134	MET	CA-C-N	-5.89	114.31	120.38
1	A	134	MET	C-N-CA	-5.89	114.31	120.38
1	A	177	PHE	N-CA-C	-5.85	99.41	108.42
1	A	98	VAL	CB-CA-C	-5.80	103.03	110.98
1	A	262	ASP	N-CA-C	5.72	117.60	111.36
1	A	174	ILE	CB-CA-C	-5.66	102.70	110.96
1	A	246	SER	CA-CB-OG	-5.43	100.24	111.10
1	A	107	ARG	CA-CB-CG	-5.31	103.49	114.10
1	A	256	THR	CB-CA-C	-5.04	102.42	110.79

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	1341	0	1325	12	0
2	A	1	0	0	0	0
3	A	47	0	0	0	0
All	All	1389	0	1325	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 4.

All (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:A:137:ARG:NH1	1:A:157:LEU:HB2	1.90	0.86
1:A:137:ARG:HH11	1:A:157:LEU:HB2	1.40	0.86

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:105:THR:HG22	1:A:108:ASP:H	1.54	0.72
1:A:258:GLY:O	1:A:262:ASP:HB2	1.94	0.67
1:A:116:LYS:HE2	1:A:116:LYS:HA	1.83	0.60
1:A:128:LEU:HD12	1:A:272:ALA:HA	1.96	0.48
1:A:113:LYS:N	1:A:113:LYS:HD2	2.26	0.48
1:A:133:PRO:HG2	1:A:267:GLY:HA3	1.96	0.47
1:A:143:ASP:N	1:A:144:PRO:CD	2.83	0.41
1:A:136:PRO:O	1:A:137:ARG:HB3	2.21	0.41
1:A:147:PRO:O	1:A:148:ASP:HB2	2.21	0.41
1:A:136:PRO:O	1:A:137:ARG:CB	2.69	0.41

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	174/289 (60%)	170 (98%)	2 (1%)	2 (1%)	11 7

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	160	SER
1	A	159	ASN

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	146/229 (64%)	133 (91%)	13 (9%)	9 5

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

Mol	Chain	Res	Type
1	A	105	THR
1	A	106	LEU
1	A	111	ARG
1	A	113	LYS
1	A	115	VAL
1	A	116	LYS
1	A	118	GLU
1	A	128	LEU
1	A	141	VAL
1	A	151	VAL
1	A	156	ARG
1	A	249	THR
1	A	262	ASP

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

Mol	Chain	Res	Type
1	A	109	HIS
1	A	253	GLN

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 oligosaccharides in this entry.

5.6 Ligand geometry

Of 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

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

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, 95th 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 ²)	Q<0.9
1	A	176/289 (60%)	0.32	11 (6%) 26 29	25, 36, 65, 96	0

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	97	PRO	5.9
1	A	159	ASN	4.5
1	A	143	ASP	3.6
1	A	272	ALA	3.1
1	A	157	LEU	2.6
1	A	124	GLY	2.6
1	A	98	VAL	2.5
1	A	145	ASN	2.2
1	A	142	PRO	2.1
1	A	147	PRO	2.1
1	A	111	ARG	2.1

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, 95th 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	CL	A	401	1/1	0.95	0.17	62,62,62,62	0

6.5 Other polymers [i](#)

There are no such residues in this entry.