



Full wwPDB X-ray Structure Validation Report ⓘ

Sep 28, 2024 – 10:03 pm BST

PDB ID : 4CMH
Title : Crystal structure of CD38 with a novel CD38-targeting antibody SAR650984
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Deposited on : 2014-01-15
Resolution : 1.53 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 : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 3.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.003 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.39

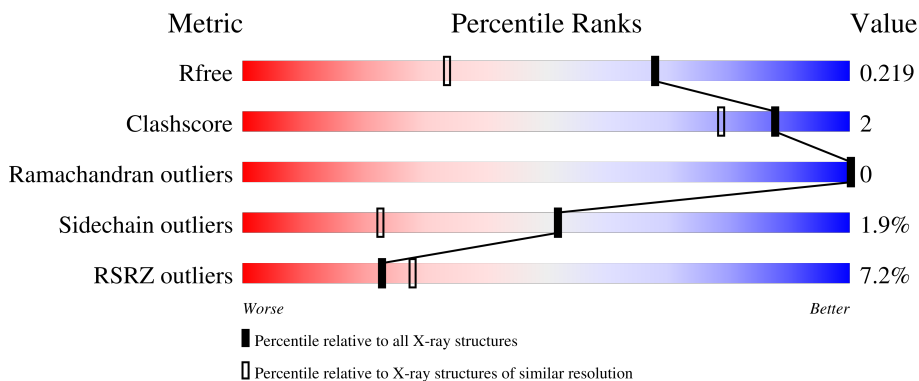
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.53 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	3511 (1.56-1.52)
Clashscore	180529	3784 (1.56-1.52)
Ramachandran outliers	177936	3720 (1.56-1.52)
Sidechain outliers	177891	3717 (1.56-1.52)
RSRZ outliers	164620	3510 (1.56-1.52)

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	256	
2	B	234	
3	C	214	

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 5901 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 ADP-RIBOSYL CYCLASE 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	240	1961	1242	337	365	17	0	4	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	100	ASP	ASN	engineered mutation	UNP P28907
A	164	ALA	ASN	engineered mutation	UNP P28907
A	209	ASP	ASN	engineered mutation	UNP P28907
A	219	ASP	ASN	engineered mutation	UNP P28907

- Molecule 2 is a protein called HEAVY CHAIN OF SAR650984-FAB FRAGMENT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	216	1650	1045	268	330	7	0	6	0

- Molecule 3 is a protein called LIGHT CHAIN OF SAR650984-FAB FRAGMENT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	213	1700	1069	286	339	6	0	7	0

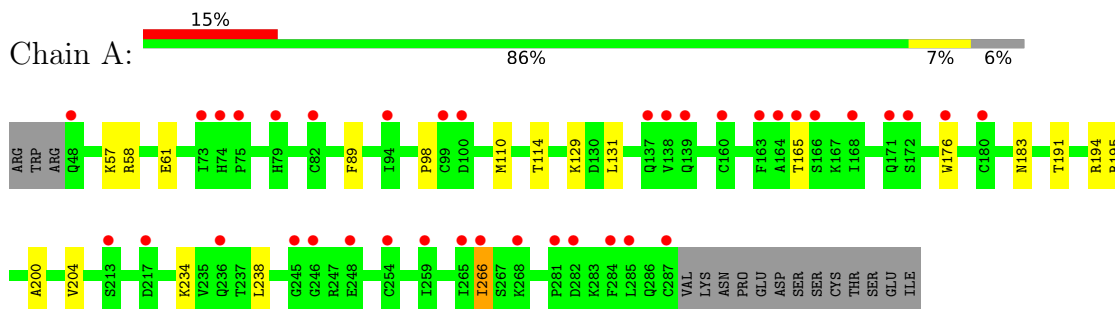
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	130	Total 130	O 130	0	0
4	B	242	Total 242	O 242	0	0
4	C	218	Total 218	O 218	0	0

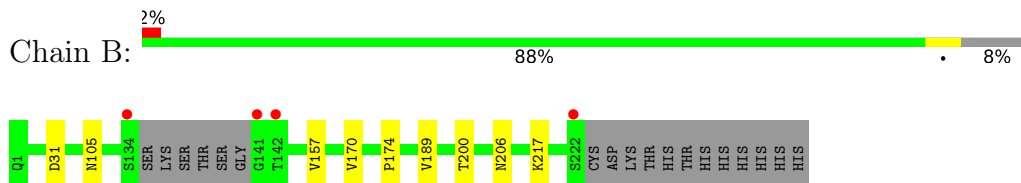
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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.

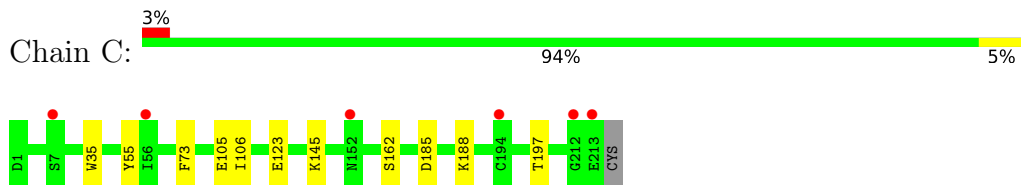
- Molecule 1: ADP-RIBOSYL CYCLASE 1



- Molecule 2: HEAVY CHAIN OF SAR650984-FAB FRAGMENT



- Molecule 3: LIGHT CHAIN OF SAR650984-FAB FRAGMENT



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	43.62Å 111.49Å 147.88Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	26.21 – 1.53 26.21 – 1.53	Depositor EDS
% Data completeness (in resolution range)	99.5 (26.21-1.53) 99.4 (26.21-1.53)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.96 (at 1.53Å)	Xtrriage
Refinement program	BUSTER 2.11.4	Depositor
R, R_{free}	0.188 , 0.208 0.195 , 0.219	Depositor DCC
R_{free} test set	5462 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	23.3	Xtrriage
Anisotropy	0.041	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 40.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	5901	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.37% 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 [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	0.53	0/2021	0.64	0/2737
2	B	0.54	0/1700	0.68	0/2315
3	C	0.55	0/1744	0.69	0/2370
All	All	0.54	0/5465	0.67	0/7422

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	1961	0	1912	12	0
2	B	1650	0	1608	4	0
3	C	1700	0	1655	7	0
4	A	130	0	0	1	0
4	B	242	0	0	0	0
4	C	218	0	0	2	0
All	All	5901	0	5175	20	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 2.

All (20) 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:110[B]:MET:SD	1:A:191:THR:HG22	2.29	0.73
3:C:106[B]:ILE:HD11	4:C:2023:HOH:O	2.04	0.58
1:A:110[B]:MET:SD	1:A:191:THR:CG2	2.94	0.56
2:B:170:VAL:HG22	2:B:189[A]:VAL:HG22	1.90	0.53
1:A:195:ARG:HD3	2:B:31:ASP:HB3	1.92	0.51
1:A:114[B]:THR:HG23	4:A:2066:HOH:O	2.11	0.51
1:A:58:ARG:HD2	1:A:61:GLU:OE1	2.15	0.47
3:C:145:LYS:HB3	3:C:197:THR:HB	1.97	0.47
1:A:234:LYS:HD2	3:C:55:TYR:OH	2.17	0.45
1:A:238:LEU:HD22	1:A:266:ILE:HG13	1.98	0.45
1:A:191:THR:O	1:A:194:ARG:HG2	2.18	0.44
2:B:174:PRO:HD2	3:C:162:SER:OG	2.18	0.43
1:A:110[B]:MET:HE1	1:A:191:THR:HG22	2.00	0.43
2:B:200:THR:HG23	2:B:217:LYS:HE3	2.01	0.42
3:C:123:GLU:HG3	4:C:2141:HOH:O	2.19	0.42
3:C:35:TRP:CD2	3:C:73:PHE:HB2	2.55	0.42
3:C:185:ASP:O	3:C:188:LYS:HG2	2.21	0.40
1:A:98:PRO:O	1:A:183:ASN:HA	2.21	0.40
1:A:110[B]:MET:CE	1:A:191:THR:HG22	2.50	0.40
1:A:200:ALA:HB1	1:A:204:VAL:HG22	2.03	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	242/256 (94%)	235 (97%)	7 (3%)	0	100	100
2	B	218/234 (93%)	215 (99%)	3 (1%)	0	100	100
3	C	218/214 (102%)	213 (98%)	5 (2%)	0	100	100
All	All	678/704 (96%)	663 (98%)	15 (2%)	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	223/236 (94%)	216 (97%)	7 (3%)	35 8
2	B	186/197 (94%)	183 (98%)	3 (2%)	58 30
3	C	194/188 (103%)	193 (100%)	1 (0%)	86 76
All	All	603/621 (97%)	592 (98%)	11 (2%)	52 25

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	57	LYS
1	A	89	PHE
1	A	129	LYS
1	A	131	LEU
1	A	165	THR
1	A	176	TRP
1	A	266	ILE
2	B	105	ASN
2	B	157	VAL
2	B	206	ASN
3	C	105	GLU

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

Mol	Chain	Res	Type
3	C	27	GLN
3	C	160	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 oligosaccharides 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, 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	240/256 (93%)	1.04	38 (15%) 6 6	13, 38, 67, 96	4 (1%)
2	B	216/234 (92%)	0.04	4 (1%) 66 75	10, 23, 41, 87	6 (2%)
3	C	213/214 (99%)	0.10	6 (2%) 55 63	11, 25, 41, 74	7 (3%)
All	All	669/704 (95%)	0.42	48 (7%) 23 28	10, 27, 60, 96	17 (2%)

All (48) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	176	TRP	4.3
2	B	134	SER	4.0
1	A	287	CYS	3.9
1	A	213	SER	3.8
3	C	7	SER	3.8
1	A	285	LEU	3.8
1	A	82	CYS	3.7
2	B	222	SER	3.7
1	A	266	ILE	3.5
1	A	245	GLY	3.5
1	A	73	ILE	3.4
1	A	163	PHE	3.4
1	A	138	VAL	3.3
3	C	152	ASN	3.3
1	A	180	CYS	3.2
1	A	79	HIS	3.1
1	A	284	PHE	3.1
1	A	164	ALA	3.0
1	A	139	GLN	2.9
3	C	212	GLY	2.9
1	A	254	CYS	2.8
1	A	246	GLY	2.6
3	C	56	ILE	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	75	PRO	2.6
1	A	48	GLN	2.5
2	B	142	THR	2.5
1	A	168	ILE	2.4
3	C	213	GLU	2.4
3	C	194	CYS	2.3
1	A	282	ASP	2.3
1	A	217	ASP	2.3
1	A	171	GLN	2.2
1	A	281	PRO	2.2
1	A	99	CYS	2.2
2	B	141	GLY	2.2
1	A	94	ILE	2.2
1	A	268	LYS	2.2
1	A	248	GLU	2.1
1	A	172	SER	2.1
1	A	160	CYS	2.1
1	A	259	ILE	2.1
1	A	165	THR	2.1
1	A	74	HIS	2.1
1	A	236	GLN	2.1
1	A	265	ILE	2.1
1	A	100	ASP	2.1
1	A	166	SER	2.1
1	A	137	GLN	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.