WORLDWIDE PDB

PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report (i)

Jun 12, 2024 – 09:39 AM EDT

PDB ID	:	2CBE
Title	:	STRUCTURE OF NATIVE AND APO CARBONIC ANHYDRASE II AND SOME OF ITS ANION-LIGAND COMPLEXES
Authors	:	Hakansson, K.; Carlsson, M.; Svensson, L.A.; Liljas, A.
Deposited on	:	1992-06-01
Resolution	:	1.82 Å(reported)

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

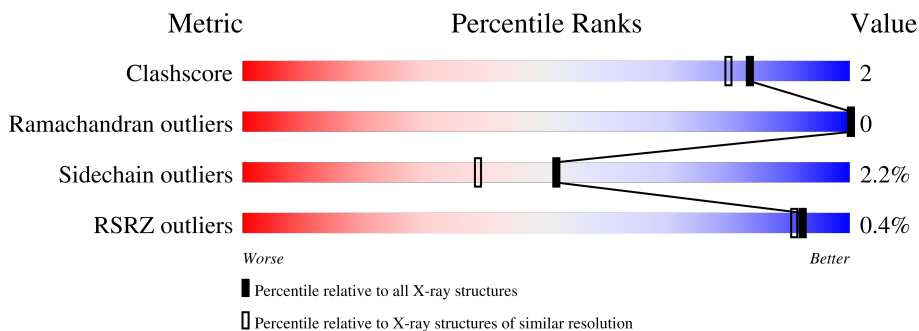|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.20.1
EDS	:	2.36.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

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 1.82 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	Percentile Ranks	Value
Clashscore		2
Ramachandran outliers		0
Sidechain outliers		2.2%
RSRZ outliers		0.4%

Worse   *Better*

▮ Percentile relative to all X-ray structures
▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	8401 (1.84-1.80)
Ramachandran outliers	138981	8290 (1.84-1.80)
Sidechain outliers	138945	8290 (1.84-1.80)
RSRZ outliers	127900	7371 (1.84-1.80)

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 >=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 <=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	260	80% 17% ··

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 2297 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 CARBONIC ANHYDRASE II.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	258	Total 2079	C 1333	N 360	O 384	S 2	0	4	0

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	218	Total 218	O 218	0	0

W O R L D W I D E
wwPDB
PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report

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: CARBONIC ANHYDRASE II
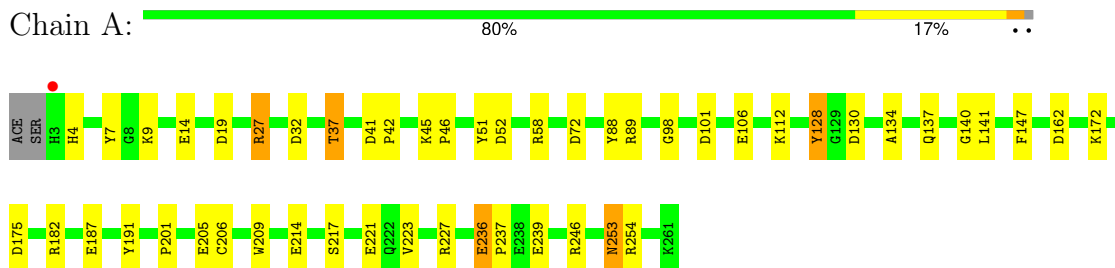
4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	42.70Å 41.70Å 73.00Å 90.00° 104.60° 90.00°	Depositor
Resolution (Å)	10.00 – 1.82 35.91 – 1.83	Depositor EDS
% Data completeness (in resolution range)	(Not available) (10.00-1.82) 65.3 (35.91-1.83)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	1.28 (at 1.83Å)	Xtriage
Refinement program	PROFFT	Depositor
R, R_{free}	0.158 , (Not available) 0.154 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å^2)	12.5	Xtriage
Anisotropy	0.237	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 70.5	EDS
L-test for twinning [2]	$<|L|> = 0.51, <L^2> = 0.34$	Xtriage
Estimated twinning fraction	0.040 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	2297	wwPDB-VP
Average B, all atoms (Å^2)	15.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.04% of the height of the origin peak. No significant pseudotranslation is detected.*

---

[1]Intensities estimated from amplitudes.
[2]Theoretical values of $<|L|>$, $<L^2>$ 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	1.18	1/2161 (0.0%)	1.78	48/2931 (1.6%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	2	0

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	254	ARG	NE-CZ	5.41	1.40	1.33

All (48) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(º)	Ideal(º)
1	A	89	ARG	NE-CZ-NH2	-12.35	114.13	120.30
1	A	182	ARG	NE-CZ-NH1	11.51	126.05	120.30
1	A	52	ASP	CB-CG-OD1	11.23	128.41	118.30
1	A	130	ASP	CB-CG-OD2	9.31	126.68	118.30
1	A	89	ARG	NE-CZ-NH1	9.13	124.86	120.30
1	A	246	ARG	NE-CZ-NH2	-8.20	116.20	120.30
1	A	72	ASP	CB-CG-OD2	8.18	125.66	118.30
1	A	147	PHE	CB-CG-CD2	-8.02	115.19	120.80
1	A	187	GLU	OE1-CD-OE2	7.89	132.77	123.30
1	A	130	ASP	OD1-CG-OD2	-7.83	108.43	123.30
1	A	221	GLU	CG-CD-OE1	7.64	133.59	118.30
1	A	52	ASP	CB-CG-OD2	-7.58	111.48	118.30
1	A	227	ARG	NE-CZ-NH1	7.57	124.08	120.30
1	A	221	GLU	OE1-CD-OE2	-7.34	114.50	123.30
1	A	130	ASP	CB-CG-OD1	7.29	124.86	118.30

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	175	ASP	CB-CG-OD1	7.27	124.84	118.30
1	A	236	GLU	CG-CD-OE1	7.22	132.75	118.30
1	A	162	ASP	CB-CG-OD1	6.99	124.59	118.30
1	A	254	ARG	NE-CZ-NH1	-6.75	116.92	120.30
1	A	51	TYR	CB-CG-CD2	-6.63	117.02	121.00
1	A	37	THR	CA-CB-CG2	6.60	121.64	112.40
1	A	14[A]	GLU	CB-CG-CD	6.43	131.55	114.20
1	A	14[B]	GLU	CB-CG-CD	6.43	131.55	114.20
1	A	101	ASP	CB-CG-OD1	6.33	124.00	118.30
1	A	32	ASP	CB-CG-OD2	-6.29	112.64	118.30
1	A	7	TYR	CB-CG-CD2	-6.26	117.25	121.00
1	A	27	ARG	CG-CD-NE	6.21	124.83	111.80
1	A	58	ARG	N-CA-CB	-6.19	99.45	110.60
1	A	209	TRP	CH2-CZ2-CE2	-6.12	111.28	117.40
1	A	191	TYR	CB-CG-CD1	6.06	124.63	121.00
1	A	51	TYR	CB-CG-CD1	6.01	124.60	121.00
1	A	128	TYR	CB-CG-CD1	-6.00	117.40	121.00
1	A	88	TYR	CZ-CE2-CD2	-5.80	114.58	119.80
1	A	236	GLU	CG-CD-OE2	-5.68	106.95	118.30
1	A	141	LEU	CA-CB-CG	5.54	128.05	115.30
1	A	19	ASP	CB-CG-OD2	-5.52	113.33	118.30
1	A	253	ASN	N-CA-CB	-5.46	100.76	110.60
1	A	4[A]	HIS	CA-CB-CG	5.40	122.78	113.60
1	A	4[B]	HIS	CA-CB-CG	5.40	122.78	113.60
1	A	191	TYR	CB-CG-CD2	-5.39	117.77	121.00
1	A	27	ARG	CA-CB-CG	5.38	125.24	113.40
1	A	217	SER	CB-CA-C	-5.20	100.22	110.10
1	A	98	GLY	O-C-N	5.13	130.90	122.70
1	A	214	GLU	OE1-CD-OE2	-5.07	117.22	123.30
1	A	89	ARG	CB-CA-C	-5.05	100.30	110.40
1	A	106	GLU	CA-CB-CG	-5.04	102.30	113.40
1	A	101	ASP	CB-CG-OD2	-5.03	113.78	118.30
1	A	223	VAL	CG1-CB-CG2	-5.02	102.87	110.90

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	4[A]	HIS	CA
1	A	4[B]	HIS	CA

There are no planarity outliers.

5.2 Too-close contacts ⓘ

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	2079	0	2021	10	0
2	A	218	0	0	3	0
All	All	2297	0	2021	10	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 (10) 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:236:GLU:HB3	1:A:237:PRO:HD2	1.79	0.65
1:A:134:ALA:O	1:A:140:GLY:HA3	2.08	0.53
1:A:236:GLU:HB3	1:A:237:PRO:CD	2.40	0.52
1:A:206:CYS:HB3	2:A:362:HOH:O	2.11	0.51
1:A:27:ARG:HG3	1:A:205:GLU:HB3	1.99	0.45
1:A:172:LYS:HE2	2:A:297:HOH:O	2.15	0.45
1:A:41:ASP:HA	1:A:42:PRO:HD2	1.89	0.43
1:A:112:LYS:NZ	2:A:423:HOH:O	2.52	0.42
1:A:128:TYR:CE1	1:A:137:GLN:HG3	2.55	0.41
1:A:45:LYS:HB3	1:A:46:PRO:CD	2.51	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	260/260 (100%)	252 (97%)	8 (3%)	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	227/224 (101%)	222 (98%)	5 (2%)	52	39

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

Mol	Chain	Res	Type
1	A	9	LYS
1	A	37	THR
1	A	201	PRO
1	A	239	GLU
1	A	253	ASN

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	67	ASN
1	A	137	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.

WORLDWIDE
wwPDB
PROTEIN DATA BANK

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

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 ⓘ

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	258/260 (99%)	-0.79	1 (0%) 92 91	4, 12, 26, 34	2 (0%)

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	3	HIS	2.2

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.