



# Full wwPDB X-ray Structure Validation Report ⓘ

Dec 3, 2023 – 02:21 pm GMT

PDB ID : 2BHF  
Title : 3D structure of the reduced form of CotA  
Authors : Bento, I.; Martins, L.O.; Lopes, G.G.; Carrondo, M.A.; Lindley, P.F.  
Deposited on : 2005-01-10  
Resolution : 2.50 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>.

---

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

MolProbity : 4.02b-467  
Mogul : 1.8.4, CSD as541be (2020)  
Xtrriage (Phenix) : 1.13  
EDS : 2.36  
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

PERCENTILES INFOmissingINFO

# 1 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 4382 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 SPORE COAT PROTEIN A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	504	4060	2592	698	759	11	0	0	0

- Molecule 2 is COPPER (I) ION (three-letter code: CU1) (formula: Cu).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	4	Total	Cu	0	0
			4	4		

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			6	3	3		
3	A	1	Total	C	O	0	0
			6	3	3		

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			6	3	3		

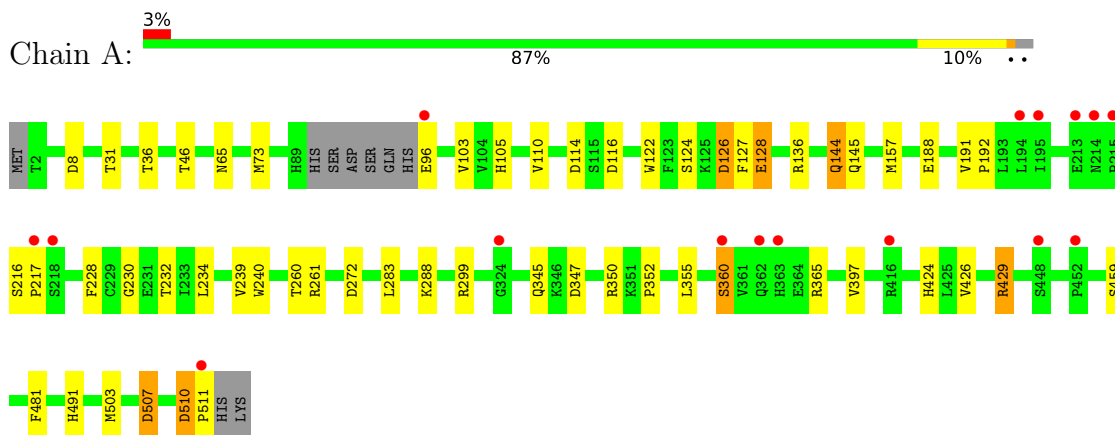
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	300	Total	O	0	0
			300	300		

## 2 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: SPORE COAT PROTEIN A



### 3 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	102.10Å 102.10Å 136.26Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	29.49 – 2.50 29.47 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.5 (29.49-2.50) 99.5 (29.47-2.50)	Depositor EDS
$R_{merge}$	0.04	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.40 (at 2.51Å)	Xtrriage
Refinement program	REFMAC 5.2.0003	Depositor
R, $R_{free}$	0.173 , 0.213 0.172 , 0.212	Depositor DCC
$R_{free}$ test set	1472 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	46.6	Xtrriage
Anisotropy	0.119	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 39.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	0.023 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	4382	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	45.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.00% 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.

## 4 Model quality [i](#)

### 4.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, CU1

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	0.57	0/4172	0.77	5/5696 (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	A	116	ASP	CB-CG-OD2	6.55	124.19	118.30
1	A	507	ASP	CB-CG-OD2	6.16	123.84	118.30
1	A	8	ASP	CB-CG-OD2	5.68	123.41	118.30
1	A	347	ASP	CB-CG-OD2	5.24	123.01	118.30
1	A	126	ASP	CB-CG-OD2	5.07	122.86	118.30

There are no chirality outliers.

There are no planarity outliers.

### 4.2 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	4060	0	3937	29	0
2	A	4	0	0	0	0
3	A	18	0	24	0	0
4	A	300	0	0	2	0
All	All	4382	0	3961	29	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 (29) 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:128:GLU:HG3	4:A:2116:HOH:O	1.83	0.77
1:A:110:VAL:H	1:A:145:GLN:HE22	1.31	0.77
1:A:110:VAL:H	1:A:145:GLN:NE2	1.85	0.74
1:A:360:SER:HA	1:A:429:ARG:HH21	1.67	0.59
1:A:272:ASP:OD2	1:A:288:LYS:HD2	2.03	0.59
1:A:228:PHE:O	1:A:260:THR:HB	2.06	0.56
1:A:114:ASP:OD2	1:A:136:ARG:HD2	2.07	0.55
1:A:65:ASN:OD1	1:A:144:GLN:HG3	2.08	0.54
1:A:124:SER:HB2	4:A:2096:HOH:O	2.09	0.53
1:A:491:HIS:HB3	1:A:503:MET:HG3	1.91	0.52
1:A:360:SER:HA	1:A:429:ARG:NH2	2.24	0.51
1:A:232:THR:CG2	1:A:239:VAL:HG13	2.42	0.49
1:A:36:THR:HA	1:A:46:THR:O	2.12	0.49
1:A:31:THR:HG22	1:A:73:MET:CE	2.43	0.49
1:A:31:THR:HG22	1:A:73:MET:HE3	1.94	0.49
1:A:103:VAL:HB	1:A:122:TRP:HA	1.96	0.47
1:A:105:HIS:CE1	1:A:424:HIS:CE1	3.06	0.44
1:A:350:ARG:C	1:A:352:PRO:HD3	2.39	0.43
1:A:510:ASP:OD1	1:A:511:PRO:HD2	2.18	0.43
1:A:188:GLU:CD	1:A:188:GLU:H	2.22	0.43
1:A:126:ASP:O	1:A:127:PHE:HB2	2.19	0.42
1:A:234:LEU:N	1:A:234:LEU:HD12	2.34	0.42
1:A:397:VAL:HG11	1:A:507:ASP:OD2	2.19	0.42
1:A:230:GLY:O	1:A:261:ARG:NH2	2.53	0.41
1:A:239:VAL:O	1:A:240:TRP:C	2.58	0.41
1:A:216:SER:HA	1:A:217:PRO:HD3	1.93	0.41
1:A:191:VAL:HA	1:A:192:PRO:HD3	1.93	0.41
1:A:426:VAL:HG11	1:A:481:PHE:HA	2.03	0.41
1:A:283:LEU:O	1:A:355:LEU:HB2	2.22	0.40

There are no symmetry-related clashes.

### 4.3 Torsion angles [\(i\)](#)

#### 4.3.1 Protein backbone [\(i\)](#)

There are no protein backbone outliers to report in this entry.



### 4.3.2 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	447/456 (98%)	436 (98%)	11 (2%)	47 73

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

Mol	Chain	Res	Type
1	A	96	GLU
1	A	128	GLU
1	A	144	GLN
1	A	157	MET
1	A	299	ARG
1	A	345	GLN
1	A	360	SER
1	A	365	ARG
1	A	429	ARG
1	A	459	SER
1	A	510	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	145	GLN

### 4.3.3 RNA [i](#)

There are no RNA molecules in this entry.

## 4.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

## 4.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 4.6 Ligand geometry [i](#)

Of 7 ligands modelled in this entry, 4 are monoatomic - leaving 3 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
3	GOL	A	1517	-	5,5,5	0.38	0	5,5,5	0.36	0
3	GOL	A	1516	-	5,5,5	0.22	0	5,5,5	0.68	0
3	GOL	A	1518	-	5,5,5	0.50	0	5,5,5	0.34	0

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
3	GOL	A	1517	-	-	2/4/4/4	-
3	GOL	A	1516	-	-	1/4/4/4	-
3	GOL	A	1518	-	-	0/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1517	GOL	C1-C2-C3-O3
3	A	1517	GOL	O2-C2-C3-O3
3	A	1516	GOL	O1-C1-C2-O2

There are no ring outliers.

No monomer is involved in short contacts.

#### 4.7 Other polymers

There are no such residues in this entry.

#### 4.8 Polymer linkage issues

There are no chain breaks in this entry.

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

### 5.1 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	504/513 (98%)	-0.27	16 (3%) 47 51	30, 43, 66, 84	0

All (16) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	363	HIS	5.1
1	A	511	PRO	4.9
1	A	362	GLN	3.5
1	A	213	GLU	3.3
1	A	416	ARG	3.0
1	A	218	SER	3.0
1	A	214	ASN	2.5
1	A	96	GLU	2.5
1	A	360	SER	2.4
1	A	324	GLY	2.3
1	A	217	PRO	2.3
1	A	452	PRO	2.3
1	A	194	LEU	2.2
1	A	215	PRO	2.2
1	A	448	SER	2.1
1	A	195	ILE	2.0

### 5.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

### 5.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.4 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
3	GOL	A	1518	6/6	0.83	0.24	59,62,62,63	0
2	CU1	A	1514	1/1	0.86	0.11	48,48,48,48	1
3	GOL	A	1517	6/6	0.93	0.20	59,60,62,66	0
3	GOL	A	1516	6/6	0.94	0.17	57,57,58,60	0
2	CU1	A	1515	1/1	0.95	0.10	43,43,43,43	1
2	CU1	A	1512	1/1	0.98	0.09	42,42,42,42	0
2	CU1	A	1513	1/1	0.99	0.08	46,46,46,46	1

## 5.5 Other polymers [i](#)

There are no such residues in this entry.