



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 25, 2017 – 07:46 AM EDT

PDB ID : 5N76  
Title : Crystal structure of the apo-form of the CO dehydrogenase accessory protein CooT from Rhodospirillum rubrum  
Authors : Timm, J.; Brochier-Armanet, C.; Perard, J.; Zambelli, B.; Ollagnier-de-Choudens, S.; Ciurli, S.; Cavazza, C.  
Deposited on : 2017-02-19  
Resolution : 1.90 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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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
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20029077
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20029077

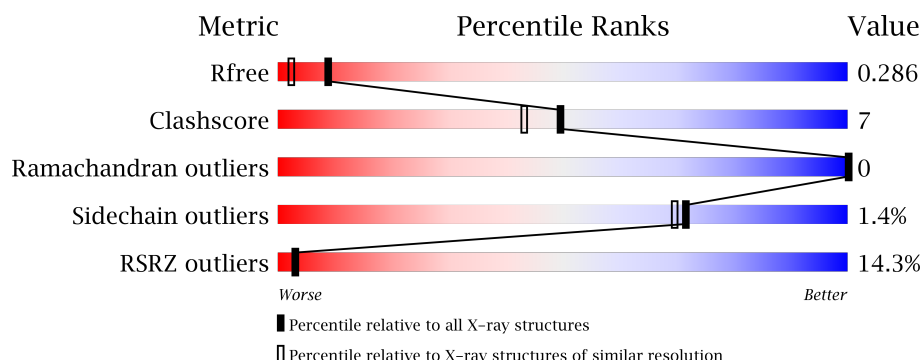
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.90 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))
$R_{free}$	100719	5047 (1.90-1.90)
Clashscore	112137	5731 (1.90-1.90)
Ramachandran outliers	110173	5669 (1.90-1.90)
Sidechain outliers	110143	5670 (1.90-1.90)
RSRZ outliers	101464	5100 (1.90-1.90)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	66	
1	B	66	
1	C	66	
1	D	66	
1	E	66	

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Mol	Chain	Length	Quality of chain
1	F	66	 A horizontal bar chart showing the quality of chain F. The bar is divided into four segments: red (18%), green (77%), yellow (11%), and grey (11%). The segments are labeled with their respective percentages: 18%, 77%, 11%, and 11%. A small black dot is located on the yellow segment.

## 2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 3047 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 CooT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	62	Total	C	N	O	S	0	5	0
			488	306	84	96	2			
1	D	62	Total	C	N	O	S	0	1	0
			467	293	82	90	2			
1	B	63	Total	C	N	O	S	0	1	0
			468	294	83	89	2			
1	C	63	Total	C	N	O	S	0	1	0
			473	297	83	91	2			
1	E	62	Total	C	N	O	S	0	2	0
			468	294	81	90	3			
1	F	59	Total	C	N	O	S	0	1	0
			444	279	77	86	2			

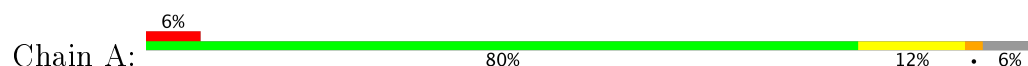
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	45	Total	O	0	0
			45	45		
2	D	47	Total	O	0	0
			47	47		
2	B	34	Total	O	0	0
			34	34		
2	C	35	Total	O	0	0
			35	35		
2	E	40	Total	O	0	0
			40	40		
2	F	38	Total	O	0	0
			38	38		

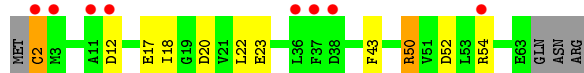
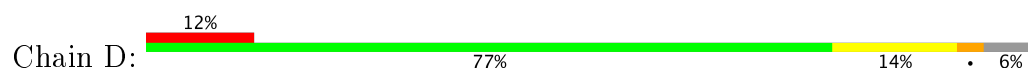
### 3 Residue-property plots [i](#)

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

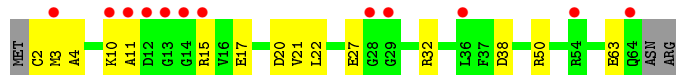
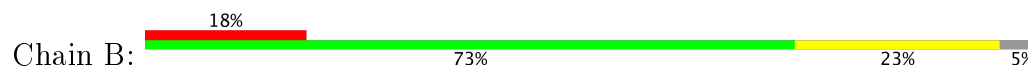
- Molecule 1: CooT



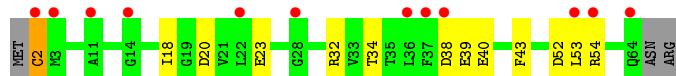
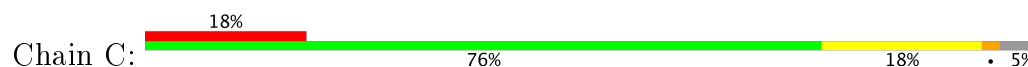
- Molecule 1: CooT



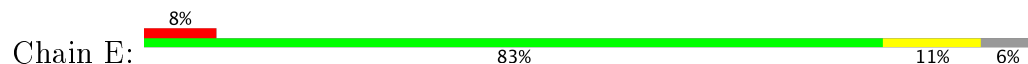
- Molecule 1: CooT



- Molecule 1: CooT

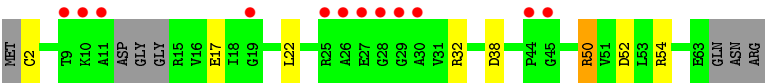


- Molecule 1: CooT



- Molecule 1: CooT





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	108.94Å 108.94Å 110.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	44.59 – 1.90 44.60 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.2 (44.59-1.90) 99.3 (44.60-1.90)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.57 (at 1.89Å)	Xtriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	(Not available) , (Not available) 0.265 , 0.286	Depositor DCC
$R_{free}$ test set	2631 reflections (5.26%)	DCC
Wilson B-factor (Å <sup>2</sup> )	32.3	Xtriage
Anisotropy	0.182	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 55.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.028 for -h,l,k 0.027 for -l,-k,-h	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	3047	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.72% 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

### 5.1 Standard geometry

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	1.03	2/506 (0.4%)	1.17	6/681 (0.9%)
1	B	0.99	1/474 (0.2%)	1.05	1/638 (0.2%)
1	C	0.90	1/479 (0.2%)	1.02	4/645 (0.6%)
1	D	0.98	0/470	1.04	3/633 (0.5%)
1	E	1.02	1/477 (0.2%)	1.13	4/642 (0.6%)
1	F	1.10	1/449 (0.2%)	1.10	2/605 (0.3%)
All	All	1.00	6/2855 (0.2%)	1.09	20/3844 (0.5%)

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	F	17	GLU	CD-OE1	-9.75	1.15	1.25
1	E	23	GLU	CD-OE2	-9.36	1.15	1.25
1	C	39	GLU	CD-OE1	-6.20	1.18	1.25
1	B	11	ALA	C-O	5.67	1.34	1.23
1	A	39[A]	GLU	CG-CD	5.22	1.59	1.51

The worst 5 of 20 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	23	GLU	OE1-CD-OE2	-9.92	111.39	123.30
1	A	2	CYS	CA-CB-SG	-6.99	101.41	114.00
1	D	50	ARG	NE-CZ-NH1	6.71	123.65	120.30
1	F	50	ARG	NE-CZ-NH2	-6.68	116.96	120.30
1	A	20	ASP	CB-CG-OD1	6.45	124.10	118.30

There are no chirality outliers.

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	488	0	506	10	0
1	B	468	0	484	12	0
1	C	473	0	489	12	1
1	D	467	0	480	13	0
1	E	468	0	485	5	1
1	F	444	0	451	6	0
2	A	45	0	0	1	1
2	B	34	0	0	1	0
2	C	35	0	0	2	0
2	D	47	0	0	2	0
2	E	40	0	0	1	1
2	F	38	0	0	0	0
All	All	3047	0	2895	37	2

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 7.

The worst 5 of 37 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:22:LEU:HD11	1:D:54:ARG:HD2	1.26	1.10
1:B:4:ALA:HB3	1:C:53:LEU:HD21	1.42	0.99
1:A:22:LEU:HD11	1:D:54:ARG:CD	1.95	0.96
1:A:22:LEU:CD1	1:D:54:ARG:HD2	2.02	0.89
1:A:22:LEU:CD1	1:D:54:ARG:CD	2.57	0.81

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:125:HOH:O	2:E:108:HOH:O[2_675]	1.96	0.24
1:C:38:ASP:OD1	1:E:11:ALA:CB[8_666]	2.16	0.04

## 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	65/66 (98%)	65 (100%)	0	0	100	100
1	B	62/66 (94%)	60 (97%)	2 (3%)	0	100	100
1	C	62/66 (94%)	62 (100%)	0	0	100	100
1	D	61/66 (92%)	61 (100%)	0	0	100	100
1	E	62/66 (94%)	61 (98%)	1 (2%)	0	100	100
1	F	56/66 (85%)	56 (100%)	0	0	100	100
All	All	368/396 (93%)	365 (99%)	3 (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	53/52 (102%)	53 (100%)	0	100	100
1	B	49/52 (94%)	48 (98%)	1 (2%)	60	55
1	C	50/52 (96%)	49 (98%)	1 (2%)	60	55
1	D	49/52 (94%)	47 (96%)	2 (4%)	35	24
1	E	50/52 (96%)	50 (100%)	0	100	100
1	F	47/52 (90%)	47 (100%)	0	100	100
All	All	298/312 (96%)	294 (99%)	4 (1%)	71	72

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	2	CYS
1	D	22	LEU
1	B	63	GLU
1	C	2	CYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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 carbohydrates 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 [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	62/66 (93%)	0.81	4 (6%) 20 22	16, 23, 44, 58	0
1	B	63/66 (95%)	0.93	12 (19%) 1 1	12, 20, 47, 58	0
1	C	63/66 (95%)	1.11	12 (19%) 1 1	12, 21, 45, 58	0
1	D	62/66 (93%)	1.10	8 (12%) 4 4	13, 24, 54, 61	1 (1%)
1	E	62/66 (93%)	0.78	5 (8%) 13 14	17, 24, 45, 52	0
1	F	59/66 (89%)	0.98	12 (20%) 1 1	15, 24, 47, 53	0
All	All	371/396 (93%)	0.95	53 (14%) 3 3	12, 23, 49, 61	1 (0%)

The worst 5 of 53 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	2	CYS	6.7
1	B	11	ALA	6.5
1	C	11	ALA	6.0
1	D	37	PHE	6.0
1	D	3	MET	5.5

### 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 carbohydrates 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.