Full wwPDB X-ray Structure Validation Report (i)

Jun 22, 2024 – 11:09 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 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 (i) 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 (1)) were used in the production of this report:

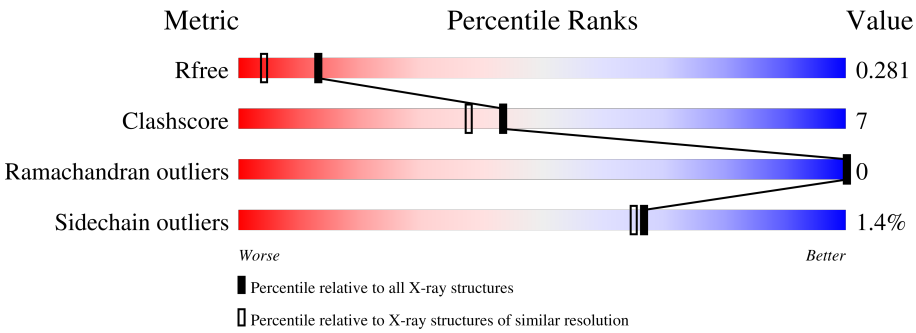
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

1 Overall quality at a glance (i)

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}	130704	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (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 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%

Mol	Chain	Length	Quality of chain
1	A	66	80% 12% • 6%
1	B	66	73% 23% 5%
1	C	66	76% 18% • 5%
1	D	66	77% 14% • 6%
1	E	66	83% 11% 6%
1	F	66	77% 11% • 11%

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

- Molecule 2 is water.

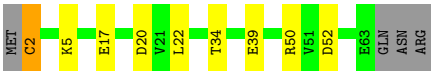
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	45	45	45	0	0
2	D	47	47	47	0	0
2	B	34	34	34	0	0
2	C	35	35	35	0	0
2	E	40	40	40	0	0
2	F	38	38	38	0	0

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. 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. 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.

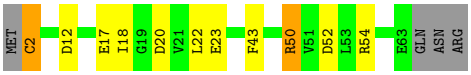
- Molecule 1: CooT

Chain A:



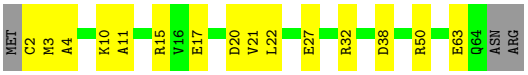
- Molecule 1: CooT

Chain D:



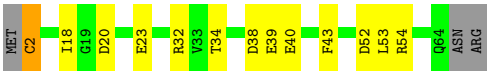
- Molecule 1: CooT

Chain B:



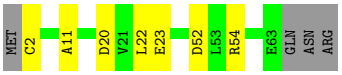
- Molecule 1: CooT

Chain C:



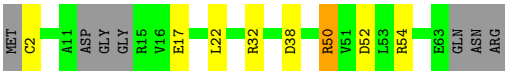
- Molecule 1: CooT

Chain E:



- Molecule 1: CooT

Chain F:


MET
C2
A11
ASP
GLY
GLY
R15
V16
E17
L22
R32
D38
R50
V51
D52
L53
R54
E63
GLN
ASN
ARG

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α, β, γ	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
$< I/\sigma(I) >$ [1]	2.57 (at 1.89Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	(Not available) , (Not available) 0.262 , 0.281	Depositor DCC
R_{free} test set	2631 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	32.3	Xtriage
Anisotropy	0.182	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 55.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.32$	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^2)	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.*

[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	1.03	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%)

All (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
1	A	39[B]	GLU	CG-CD	5.22	1.59	1.51

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
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
1	B	3	MET	CG-SD-CE	6.28	110.25	100.20
1	F	32	ARG	NE-CZ-NH1	6.22	123.41	120.30
1	D	23	GLU	OE1-CD-OE2	6.16	130.70	123.30
1	C	32	ARG	NE-CZ-NH1	6.06	123.33	120.30
1	C	20	ASP	CB-CG-OD2	-5.71	113.16	118.30
1	E	52	ASP	CB-CG-OD2	-5.62	113.24	118.30
1	C	52	ASP	CB-CG-OD2	-5.53	113.32	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	52	ASP	CB-CG-OD2	-5.50	113.35	118.30
1	E	23	GLU	CG-CD-OE1	5.46	129.22	118.30
1	C	52	ASP	CB-CG-OD1	5.42	123.17	118.30
1	A	52	ASP	CB-CG-OD1	5.33	123.09	118.30
1	D	52	ASP	CB-CG-OD1	5.08	122.87	118.30
1	E	52	ASP	CB-CG-OD1	5.07	122.86	118.30
1	A	50[A]	ARG	NE-CZ-NH2	-5.06	117.77	120.30
1	A	50[B]	ARG	NE-CZ-NH2	-5.06	117.77	120.30

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	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.

All (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
1:B:4:ALA:CB	1:C:53:LEU:HD21	2.13	0.78
1:B:21:VAL:O	1:C:53:LEU:HD22	1.86	0.76
1:B:2:CYS:HG	1:C:2:CYS:HG	0.81	0.74
1:E:20:ASP:OD2	2:E:101:HOH:O	2.13	0.66
1:F:50:ARG:NH2	1:F:52:ASP:OD2	2.28	0.65
1:B:2:CYS:HG	1:C:2:CYS:CB	2.09	0.65
1:B:15:ARG:NH1	1:B:17:GLU:OE2	2.29	0.63
1:E:54:ARG:HG3	1:F:22:LEU:HD11	1.84	0.59
1:A:2:CYS:HB2	1:D:2:CYS:SG	2.44	0.57
1:A:34[B]:THR:HG23	2:A:119:HOH:O	2.04	0.56
1:D:12:ASP:OD2	1:B:10:LYS:HE2	2.06	0.55
1:B:27:GLU:HG3	1:B:32:ARG:NH1	2.22	0.54
1:B:20:ASP:OD2	1:F:38[A]:ASP:OD2	2.26	0.54
1:A:5:LYS:HD2	1:A:17[B]:GLU:CD	2.28	0.54
1:A:22:LEU:HD12	1:D:54:ARG:CD	2.38	0.52
1:E:22:LEU:CD1	1:F:54:ARG:HG2	2.39	0.52
1:C:40:GLU:O	2:C:102:HOH:O	2.19	0.50
1:A:5:LYS:HD2	1:A:17[B]:GLU:CG	2.41	0.49
1:D:20:ASP:OD2	1:B:38:ASP:OD2	2.30	0.49
1:A:22:LEU:HD12	1:D:54:ARG:HD3	1.94	0.48
1:C:54:ARG:HA	1:C:54:ARG:HE	1.81	0.46
1:D:50:ARG:NH2	2:D:103:HOH:O	2.51	0.44
1:B:22:LEU:HD11	1:C:54:ARG:HG2	1.99	0.44
1:D:50:ARG:NH1	2:D:102:HOH:O	2.50	0.44
1:C:23:GLU:HB3	1:C:34:THR:OG1	2.19	0.42
1:E:2:CYS:HB2	1:F:2:CYS:HA	2.00	0.42
1:E:22:LEU:HD11	1:F:54:ARG:CG	2.49	0.42
1:D:17:GLU:HG3	2:B:107:HOH:O	2.18	0.42
1:B:50:ARG:NE	1:C:23:GLU:OE2	2.53	0.42
1:C:18[A]:ILE:HD11	1:C:43:PHE:HZ	1.83	0.42
1:D:18:ILE:HD11	1:D:43:PHE:HZ	1.85	0.42
1:C:40:GLU:C	2:C:102:HOH:O	2.58	0.41

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 (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	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 (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	53/52 (102%)	53 (100%)	0	100	100
1	B	49/52 (94%)	48 (98%)	1 (2%)	55	51
1	C	50/52 (96%)	49 (98%)	1 (2%)	55	51

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	D	49/52 (94%)	47 (96%)	2 (4%)	30	21
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%)	67	68

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

Sometimes 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 monosaccharides 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)

Unable to reproduce the depositors R factor - this section is therefore empty.

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

Unable to reproduce the depositors R factor - this section is therefore empty.

6.3 Carbohydrates (i)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.4 Ligands (i)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.5 Other polymers (i)

Unable to reproduce the depositors R factor - this section is therefore empty.