



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 06:10 AM GMT

PDB ID : 2W70
Title : CRYSTAL STRUCTURE OF BIOTIN CARBOXYLASE FROM E. COLI IN
COMPLEX WITH THE AMINO-THIAZOLE-PYRIMIDINE FRAGMENT
Authors : Mochalkin, I.; Miller, J.R.
Deposited on : 2008-12-19
Resolution : 1.77 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
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>
with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467
Mogul : 1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
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) : trunk26865

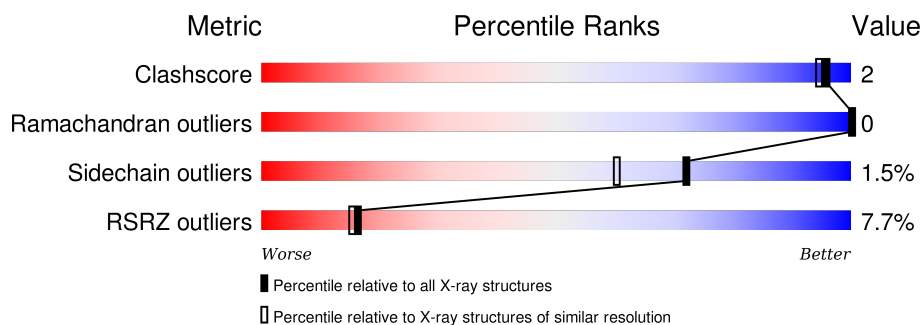
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.77 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))
Clashscore	102246	7658 (1.80-1.76)
Ramachandran outliers	100387	7570 (1.80-1.76)
Sidechain outliers	100360	7569 (1.80-1.76)
RSRZ outliers	91569	6671 (1.80-1.76)

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 ≥ 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	449	<div> <div>2%</div> <div>96%</div> <div>..</div> </div>
1	B	449	<div> <div>13%</div> <div>95%</div> <div>..</div> </div>

2 Entry composition [i](#)

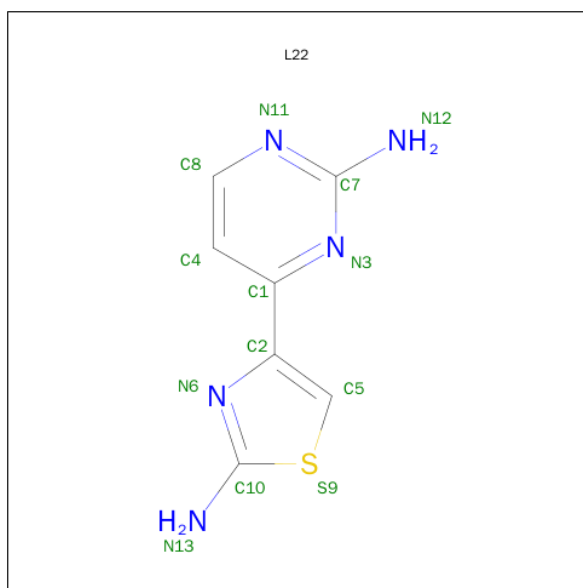
There are 4 unique types of molecules in this entry. The entry contains 7863 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 BIOTIN CARBOXYLASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	446	Total	C	N	O	S	0	4	0
			3444	2170	614	638	22			
1	B	446	Total	C	N	O	S	0	4	0
			3449	2172	617	638	22			

- Molecule 2 is 4-(2-AMINO-1,3-THIAZOL-4-YL)PYRIMIDIN-2-AMINE (three-letter code: L22) (formula: C₇H₇N₅S).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	S	0	0
			13	7	5	1		
2	B	1	Total	C	N	S	0	0
			13	7	5	1		

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total 1	Cl 1	0	0
3	A	1	Total 1	Cl 1	0	0

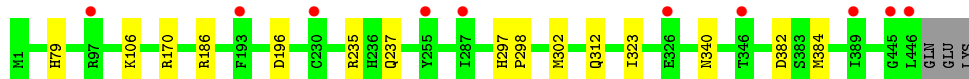
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	538	Total 538	O 538	0	0
4	B	404	Total 404	O 404	0	0

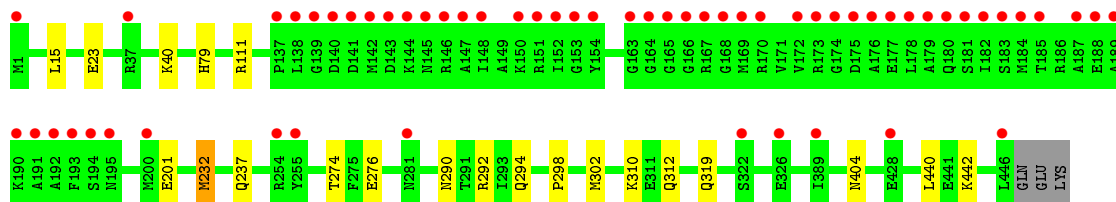
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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 ($\text{RSRZ} > 2$). 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: BIOTIN CARBOXYLASE



• Molecule 1: BIOTIN CARBOXYLASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	84.23Å 106.22Å 122.64Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.77 29.33 – 1.77	Depositor EDS
% Data completeness (in resolution range)	99.8 (20.00-1.77) 93.6 (29.33-1.77)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.92 (at 1.77Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.174 , 0.202 0.192 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	DCC
Wilson B-factor (Å ²)	18.6	Xtriage
Anisotropy	0.292	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 44.1	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	0 of 106998 reflections	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	7863	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.91% 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, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: L22, CL

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	0.39	0/3527	0.57	0/4759
1	B	0.38	0/3532	0.56	0/4766
All	All	0.39	0/7059	0.57	0/9525

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

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	3444	0	3476	5	0
1	B	3449	0	3479	16	0
2	A	13	0	7	0	0
2	B	13	0	7	0	0
3	A	1	0	0	0	0
3	B	1	0	0	1	0
4	A	538	0	0	0	0
4	B	404	0	0	3	0
All	All	7863	0	6969	21	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 (21) 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:B:232:MET:HE3	4:B:2390:HOH:O	1.81	0.80
1:B:232:MET:HE2	1:B:440:LEU:HB2	1.82	0.62
1:B:232:MET:CE	1:B:232:MET:HA	2.31	0.60
1:B:232:MET:HE2	1:B:232:MET:HA	1.86	0.56
1:A:340:ASN:HD22	1:A:384:MET:HA	1.70	0.56
1:B:292:ARG:NH1	3:B:1448:CL:CL	2.76	0.55
1:A:79:HIS:HE2	1:A:312:GLN:NE2	2.06	0.54
1:A:186:ARG:HG2	1:A:196:ASP:HB2	1.90	0.53
1:B:276:GLU:CD	1:B:290:ASN:HD21	2.14	0.51
1:B:79:HIS:HE2	1:B:312:GLN:NE2	2.09	0.50
1:B:232:MET:HE1	1:B:440:LEU:N	2.29	0.48
1:B:298:PRO:O	1:B:302:MET:HG2	2.13	0.47
1:B:319:GLN:NE2	4:B:2259:HOH:O	2.48	0.46
1:B:274:THR:HG21	1:B:294:GLN:HE22	1.81	0.46
1:B:23:GLU:OE1	1:B:310:LYS:NZ	2.40	0.46
1:B:232:MET:CE	1:B:440:LEU:HB2	2.45	0.45
1:B:15:LEU:CD2	1:B:40:LYS:HD2	2.48	0.44
1:A:298:PRO:O	1:A:302:MET:HG2	2.19	0.43
1:A:297:HIS:N	1:A:298:PRO:CD	2.83	0.41
1:B:15:LEU:HD22	1:B:40:LYS:HD2	2.02	0.41
1:B:404:ASN:ND2	4:B:2351:HOH:O	2.50	0.41

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	448/449 (100%)	440 (98%)	8 (2%)	0	100	100
1	B	448/449 (100%)	436 (97%)	12 (3%)	0	100	100
All	All	896/898 (100%)	876 (98%)	20 (2%)	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	362/361 (100%)	355 (98%)	7 (2%)	65	49
1	B	362/361 (100%)	356 (98%)	6 (2%)	68	54
All	All	724/722 (100%)	711 (98%)	13 (2%)	72	52

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	106	LYS
1	A	170	ARG
1	A	235	ARG
1	A	237	GLN
1	A	323	ILE
1	A	382[A]	ASP
1	A	382[B]	ASP
1	B	111	ARG
1	B	201	GLU
1	B	232	MET
1	B	237[A]	GLN
1	B	237[B]	GLN
1	B	442	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	180	GLN
1	A	312	GLN
1	A	319	GLN
1	A	340	ASN
1	A	404	ASN
1	A	431	GLN

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Mol	Chain	Res	Type
1	B	94	GLN
1	B	206	ASN
1	B	290	ASN
1	B	294	GLN
1	B	312	GLN
1	B	319	GLN
1	B	404	ASN

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.

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry ⓘ

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 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	$\# Z > 2$
2	L22	A	1447	-	11,14,14	0.62	0	12,19,19	3.35	6 (50%)
2	L22	B	1447	-	11,14,14	0.66	0	12,19,19	3.22	6 (50%)

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
2	L22	A	1447	-	-	0/2/4/4	0/2/2/2
2	L22	B	1447	-	-	0/2/4/4	0/2/2/2

There are no bond length outliers.

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
2	A	1447	L22	N11-C7-N3	-4.93	120.63	125.78
2	B	1447	L22	N11-C7-N3	-4.41	121.17	125.78
2	A	1447	L22	C4-C8-N11	-3.48	119.92	123.90
2	B	1447	L22	C4-C8-N11	-3.34	120.09	123.90
2	B	1447	L22	C4-C1-N3	-2.04	119.20	122.01
2	A	1447	L22	C2-C1-N3	2.03	118.77	116.26
2	A	1447	L22	N12-C7-N11	2.63	119.76	117.39
2	B	1447	L22	C2-C1-N3	2.69	119.58	116.26
2	B	1447	L22	C8-N11-C7	4.37	120.25	116.32
2	A	1447	L22	C8-N11-C7	5.11	120.92	116.32
2	A	1447	L22	C1-N3-C7	7.01	120.14	116.34
2	B	1447	L22	C1-N3-C7	7.23	120.26	116.34

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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	446/449 (99%)	0.17	10 (2%) 65 64	16, 21, 28, 36	0
1	B	446/449 (99%)	0.74	59 (13%) 4 4	16, 21, 57, 60	0
All	All	892/898 (99%)	0.46	69 (7%) 16 15	16, 21, 46, 60	0

All (69) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	167	ARG	9.1
1	B	168	GLY	8.8
1	B	193	PHE	8.7
1	B	142	MET	7.9
1	B	166	GLY	7.3
1	B	143	ASP	6.4
1	B	187	ALA	6.4
1	B	180	GLN	6.3
1	B	192	ALA	6.2
1	B	150	LYS	6.2
1	B	154	TYR	5.9
1	B	194	SER	5.9
1	B	184	MET	5.7
1	B	146	ARG	5.5
1	B	191	ALA	5.1
1	B	141	ASP	4.8
1	B	177	GLU	4.8
1	B	164	GLY	4.8
1	B	152	ILE	4.7
1	B	151	ARG	4.7
1	B	140	ASP	4.5
1	B	181	SER	4.5
1	A	446	LEU	4.3
1	B	176	ALA	4.3

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Mol	Chain	Res	Type	RSRZ
1	B	190	LYS	4.1
1	B	183	SER	4.0
1	B	144	LYS	4.0
1	B	147	ALA	3.8
1	B	148	ILE	3.8
1	B	185	THR	3.8
1	B	188	GLU	3.8
1	B	139	GLY	3.8
1	B	189	ALA	3.8
1	B	165	GLY	3.8
1	B	163	GLY	3.6
1	B	179	ALA	3.5
1	B	254	ARG	3.5
1	B	174	GLY	3.5
1	B	170	ARG	3.3
1	B	37	ARG	3.2
1	A	445	GLY	3.1
1	B	281	ASN	3.1
1	B	255	TYR	3.1
1	B	446	LEU	3.0
1	B	153	GLY	2.8
1	B	172	VAL	2.8
1	B	173	ARG	2.8
1	B	178	LEU	2.7
1	B	1	MET	2.7
1	B	145	ASN	2.7
1	A	326	GLU	2.6
1	B	326	GLU	2.6
1	B	182	ILE	2.6
1	B	175	ASP	2.5
1	B	200	MET	2.5
1	B	322	SER	2.5
1	A	389	ILE	2.5
1	B	137	PRO	2.4
1	A	346	THR	2.4
1	A	193	PHE	2.4
1	A	287	ILE	2.3
1	B	169	MET	2.3
1	B	389	ILE	2.3
1	A	97	ARG	2.3
1	B	428	GLU	2.2
1	A	255	TYR	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	138	LEU	2.1
1	A	230	CYS	2.0
1	B	195	ASN	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 carbohydrates in this entry.

6.4 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95th 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	LLDF	B-factors(Å ²)	Q<0.9
2	L22	A	1447	13/13	0.94	0.11	-0.17	20,22,25,29	0
2	L22	B	1447	13/13	0.87	0.11	-0.63	35,36,37,39	0
3	CL	B	1448	1/1	0.98	0.06	-2.95	21,21,21,21	0
3	CL	A	1448	1/1	1.00	0.02	-4.99	17,17,17,17	0

6.5 Other polymers [i](#)

There are no such residues in this entry.