wwPDB X-ray Structure Validation Summary Report (i)

Dec 6, 2023 – 02:15 am GMT

PDB ID	:	2VJQ
Title	:	Formyl-CoA transferase mutant variant W48Q
Authors	:	Toyota, C.G.; Berthold, C.L.; Gruez, A.; Jonsson, S.; Lindqvist, Y.; Cambillau, C.; Richards, N.G.J.
Deposited on	:	2007-12-11
Resolution	:	1.80 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*
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 (i)) were used in the production of this report:

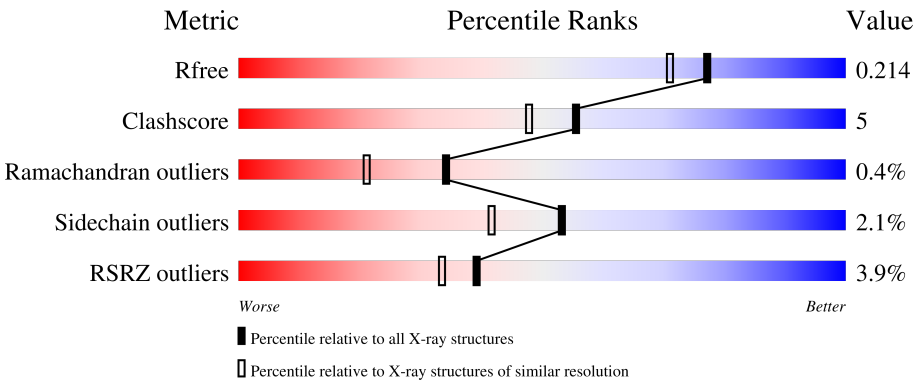
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 1.80 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	5950 (1.80-1.80)
Clashscore	141614	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)
RSRZ outliers	127900	5850 (1.80-1.80)

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	428	91% 7% •
1	B	428	7% 89% 11%
1	C	428	% 88% 11%
1	D	428	8% 90% 9% •

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 14791 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.

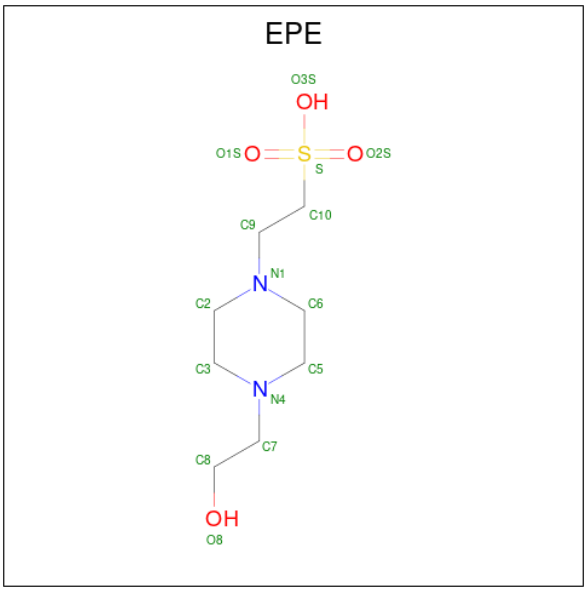
- Molecule 1 is a protein called FORMYL-COENZYME A TRANSFERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	427	3337	2111	571	631	24	0	6	0
1	B	427	3341	2114	572	631	24	0	6	0
1	C	427	3369	2132	576	637	24	0	12	0
1	D	427	3335	2109	571	630	25	0	5	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	48	GLN	TRP	engineered mutation	UNP O06644
A	186	ILE	MET	SEE REMARK 999	UNP O06644
B	48	GLN	TRP	engineered mutation	UNP O06644
B	186	ILE	MET	SEE REMARK 999	UNP O06644
C	48	GLN	TRP	engineered mutation	UNP O06644
C	186	ILE	MET	SEE REMARK 999	UNP O06644
D	48	GLN	TRP	engineered mutation	UNP O06644
D	186	ILE	MET	SEE REMARK 999	UNP O06644

- Molecule 2 is 4-(2-HYDROXYETHYL)-1-PIPERAZINE ETHANESULFONIC ACID (three-letter code: EPE) (formula: $C_8H_{18}N_2O_4S$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
2	B	1	15	8	2	4	1	0	0
			Total	C	N	O	S		
2	D	1	15	8	2	4	1	0	0

- Molecule 3 is water.

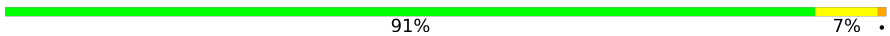
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	396	396	396	0	0
			Total	O		
3	B	322	322	322	0	0
			Total	O		
3	C	390	390	390	0	0
			Total	O		
3	D	271	271	271	0	0

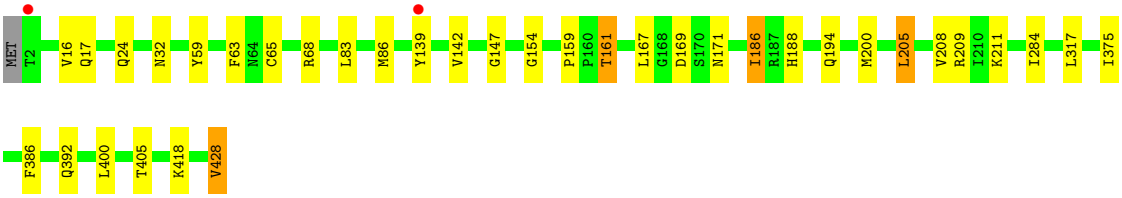
3 Residue-property plots (i)

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 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: FORMYL-COENZYME A TRANSFERASE

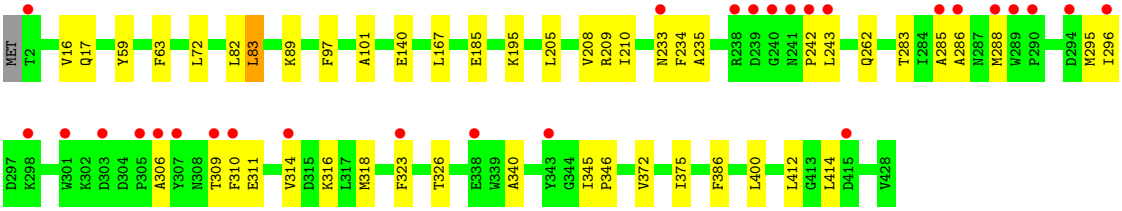
Chain A:





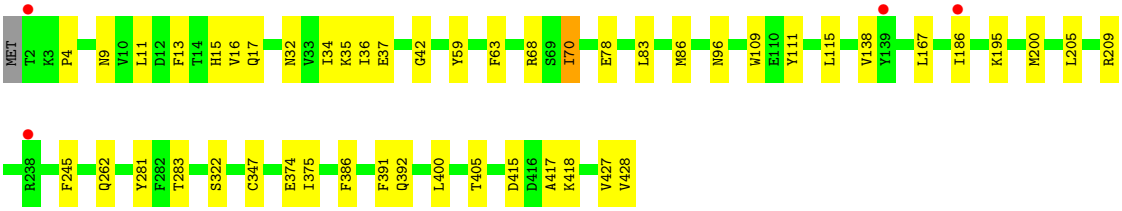
• Molecule 1: FORMYL-COENZYME A TRANSFERASE

Chain B:



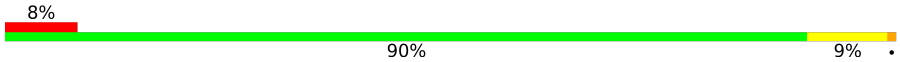
• Molecule 1: FORMYL-COENZYME A TRANSFERASE

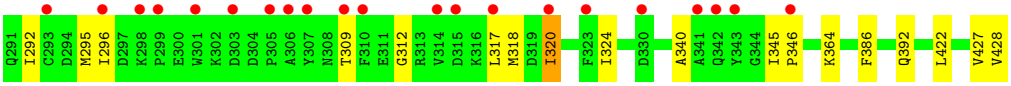
Chain C:



• Molecule 1: FORMYL-COENZYME A TRANSFERASE

Chain D:




Q291
I292
C293
D294
M295
I296
D297
K298
P299
E300
W301
K302
D303
D304
P305
A306
Y307
N308
T309
F310
E311
G312
R313
V314
D315
K316
L317
M318
D319
I320
F323
I324
D330
A340
A341
Q342
Y343
G344
I345
P346
K364
F386
Q392
L422
V427
V428

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	214.16Å 98.92Å 152.53Å 90.00° 135.27° 90.00°	Depositor
Resolution (Å)	30.00 – 1.80 55.83 – 1.80	Depositor EDS
% Data completeness (in resolution range)	91.8 (30.00-1.80) 91.8 (55.83-1.80)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.01 (at 1.80Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.181 , 0.212 0.185 , 0.214	Depositor DCC
R_{free} test set	9536 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	22.0	Xtriage
Anisotropy	0.374	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 30.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	0.156 for -h-2*l,k,h+l 0.022 for h,-k,-h-l 0.024 for h+2*l,-k,-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	14791	wwPDB-VP
Average B, all atoms (Å^2)	26.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.55% 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)

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

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	0.43	0/3428	0.57	0/4634
1	B	0.41	0/3432	0.55	0/4640
1	C	0.42	0/3478	0.58	0/4701
1	D	0.40	0/3423	0.54	0/4626
All	All	0.42	0/13761	0.56	0/18601

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 (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	3337	0	3290	38	0
1	B	3341	0	3295	40	0
1	C	3369	0	3335	36	0
1	D	3335	0	3285	39	0
2	B	15	0	17	0	0
2	D	15	0	17	0	0
3	A	396	0	0	1	0
3	B	322	0	0	1	0
3	C	390	0	0	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	D	271	0	0	4	0
All	All	14791	0	13239	135	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 5.

The worst 5 of 135 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:D:295:MET:HE3	1:D:345:ILE:HD12	1.24	1.12
1:A:167:LEU:HD21	1:B:167:LEU:HD21	1.24	1.11
1:C:167:LEU:HD21	1:D:167:LEU:HD21	1.25	1.08
1:D:295:MET:CE	1:D:345:ILE:HD12	1.93	0.99
1:B:295:MET:CE	1:B:345:ILE:HD12	1.97	0.94

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	431/428 (101%)	421 (98%)	9 (2%)	1 (0%)	47	33
1	B	431/428 (101%)	420 (97%)	9 (2%)	2 (0%)	29	15
1	C	437/428 (102%)	428 (98%)	8 (2%)	1 (0%)	47	33
1	D	430/428 (100%)	418 (97%)	10 (2%)	2 (0%)	29	15
All	All	1729/1712 (101%)	1687 (98%)	36 (2%)	6 (0%)	34	27

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	140	GLU

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Mol	Chain	Res	Type
1	D	140	GLU
1	A	16	VAL
1	B	16	VAL
1	C	16	VAL

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	356/351 (101%)	348 (98%)	8 (2%)	52	39
1	B	356/351 (101%)	352 (99%)	4 (1%)	73	68
1	C	362/351 (103%)	353 (98%)	9 (2%)	47	34
1	D	355/351 (101%)	345 (97%)	10 (3%)	43	30
All	All	1429/1404 (102%)	1398 (98%)	31 (2%)	53	39

5 of 31 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	70[B]	ILE
1	D	320	ILE
1	C	374	GLU
1	D	386	PHE
1	D	195	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	262	GLN
1	C	404	HIS
1	D	378	ASN
1	D	32	ASN
1	B	262	GLN

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)

2 ligands are modelled in this entry.

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	EPE	B	1429	-	15,15,15	0.86	1 (6%)	18,20,20	1.35	3 (16%)
2	EPE	D	1429	-	15,15,15	0.87	1 (6%)	18,20,20	1.09	2 (11%)

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	EPE	B	1429	-	-	2/9/19/19	0/1/1/1
2	EPE	D	1429	-	-	1/9/19/19	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	1429	EPE	C10-S	2.98	1.81	1.77

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1429	EPE	C10-S	2.82	1.81	1.77

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	1429	EPE	C6-N1-C2	2.91	115.39	108.83
2	B	1429	EPE	O1S-S-C10	2.62	110.07	106.92
2	D	1429	EPE	O3S-S-C10	2.36	109.58	105.77
2	B	1429	EPE	O3S-S-C10	2.28	109.45	105.77
2	D	1429	EPE	O1S-S-C10	2.06	109.40	106.92

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1429	EPE	C8-C7-N4-C5
2	D	1429	EPE	N4-C7-C8-O8
2	B	1429	EPE	N4-C7-C8-O8

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 (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, 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	427/428 (99%)	-0.20	2 (0%)	91	89	11, 19, 41, 48	0
1	B	427/428 (99%)	0.15	28 (6%)	18	14	11, 22, 59, 72	0
1	C	427/428 (99%)	-0.19	4 (0%)	84	82	11, 20, 41, 48	0
1	D	427/428 (99%)	0.25	33 (7%)	13	10	11, 23, 59, 73	0
All	All	1708/1712 (99%)	0.00	67 (3%)	39	33	11, 21, 52, 73	0

The worst 5 of 67 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	314	VAL	8.0
1	D	305	PRO	6.2
1	D	238	ARG	5.6
1	D	241	ASN	5.5
1	B	296	ILE	5.4

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 monosaccharides 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. 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	B-factors(Å^2)	Q<0.9
2	EPE	B	1429	15/15	0.89	0.17	26,29,30,30	15
2	EPE	D	1429	15/15	0.89	0.17	34,35,36,36	15

6.5 Other polymers (i)

There are no such residues in this entry.