



wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 13, 2023 – 07:55 AM EDT

PDB ID : 4QSL
Title : Crystal Structure of Listeria Monocytogenes Pyruvate Carboxylase
Authors : Choi, P.H.; Tong, L.
Deposited on : 2014-07-04
Resolution : 3.28 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 ⓘ 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
Xtriage (Phenix) : 1.13
EDS : 2.35.1
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) : 2.35.1

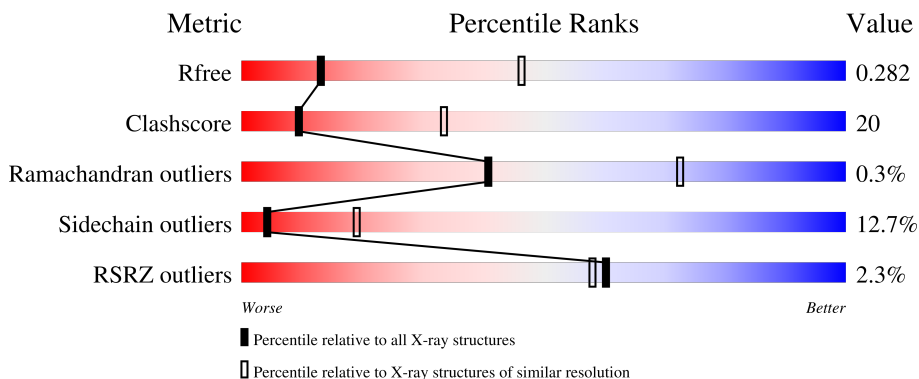
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.28 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.



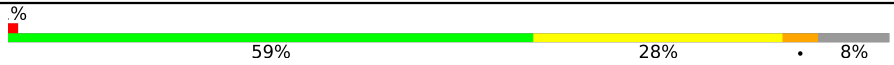

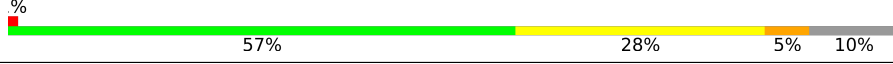
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1177 (3.32-3.24)
Clashscore	141614	1044 (3.30-3.26)
Ramachandran outliers	138981	1026 (3.30-3.26)
Sidechain outliers	138945	1025 (3.30-3.26)
RSRZ outliers	127900	1141 (3.32-3.24)

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 $\leq 5\%$. 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	1146	
1	B	1146	
1	C	1146	
1	D	1146	
1	E	1146	

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Mol	Chain	Length	Quality of chain
1	F	1146	 <p>% 59% 28% 8% 3%</p>
1	G	1146	 <p>3% 53% 25% 18% 3%</p>
1	H	1146	 <p>% 57% 28% 5% 10%</p>

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 60495 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.

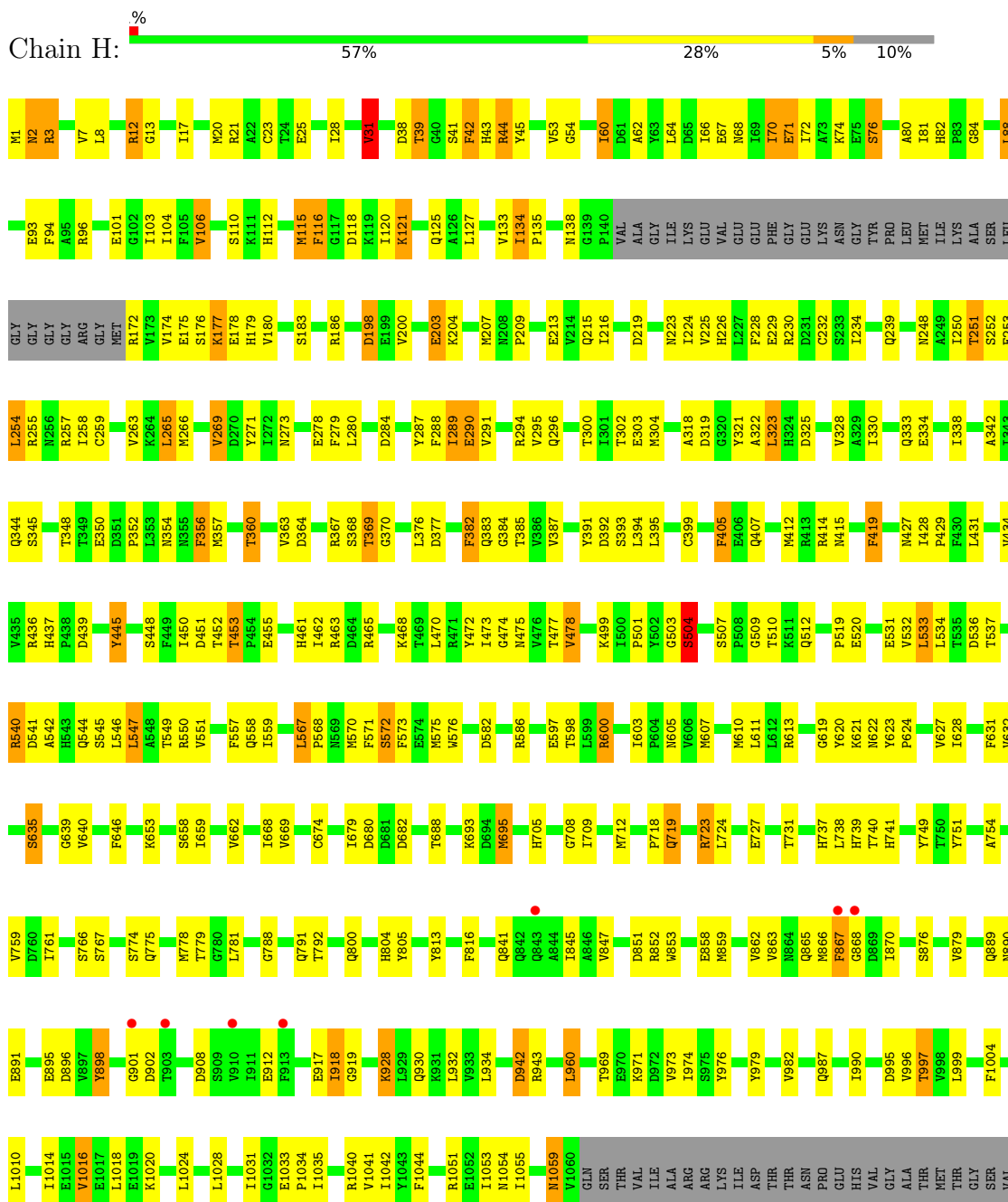
- Molecule 1 is a protein called Pyruvate carboxylase.

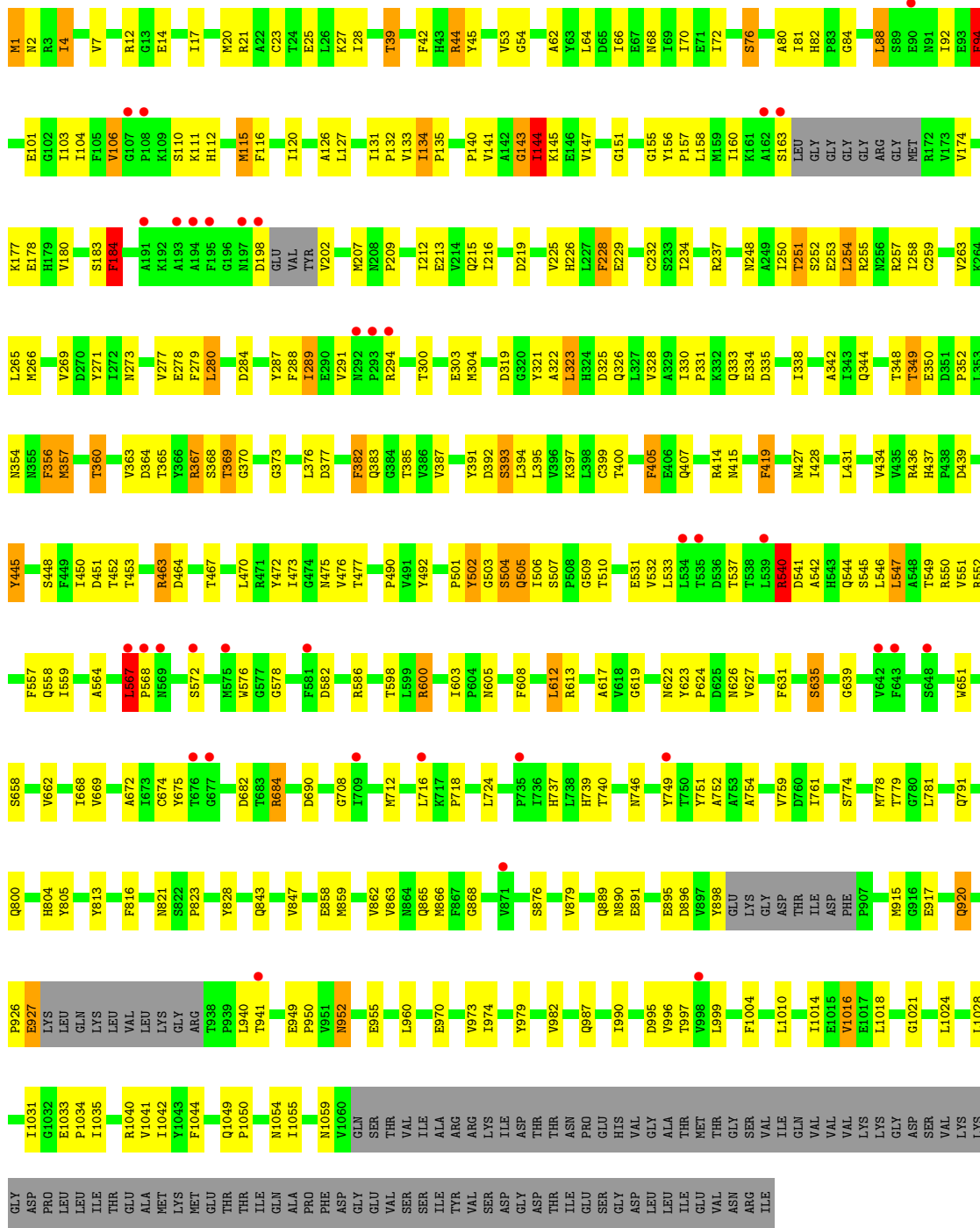
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	H	1029	7881	4992	1351	1504	34	0	0	0
1	F	1052	7969	5063	1353	1518	35	0	0	0
1	E	1031	7492	4716	1292	1459	25	0	0	0
1	G	942	6909	4338	1202	1341	28	0	0	0
1	D	1029	7881	4992	1351	1504	34	0	0	0
1	A	1052	7969	5063	1353	1518	35	0	0	0
1	B	1031	7492	4716	1292	1459	25	0	0	0
1	C	941	6902	4333	1201	1340	28	0	0	0

3 Residue-property plots

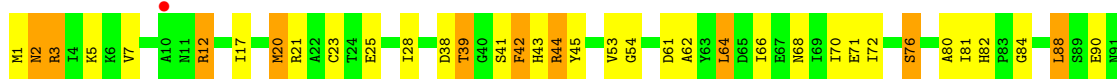
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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.

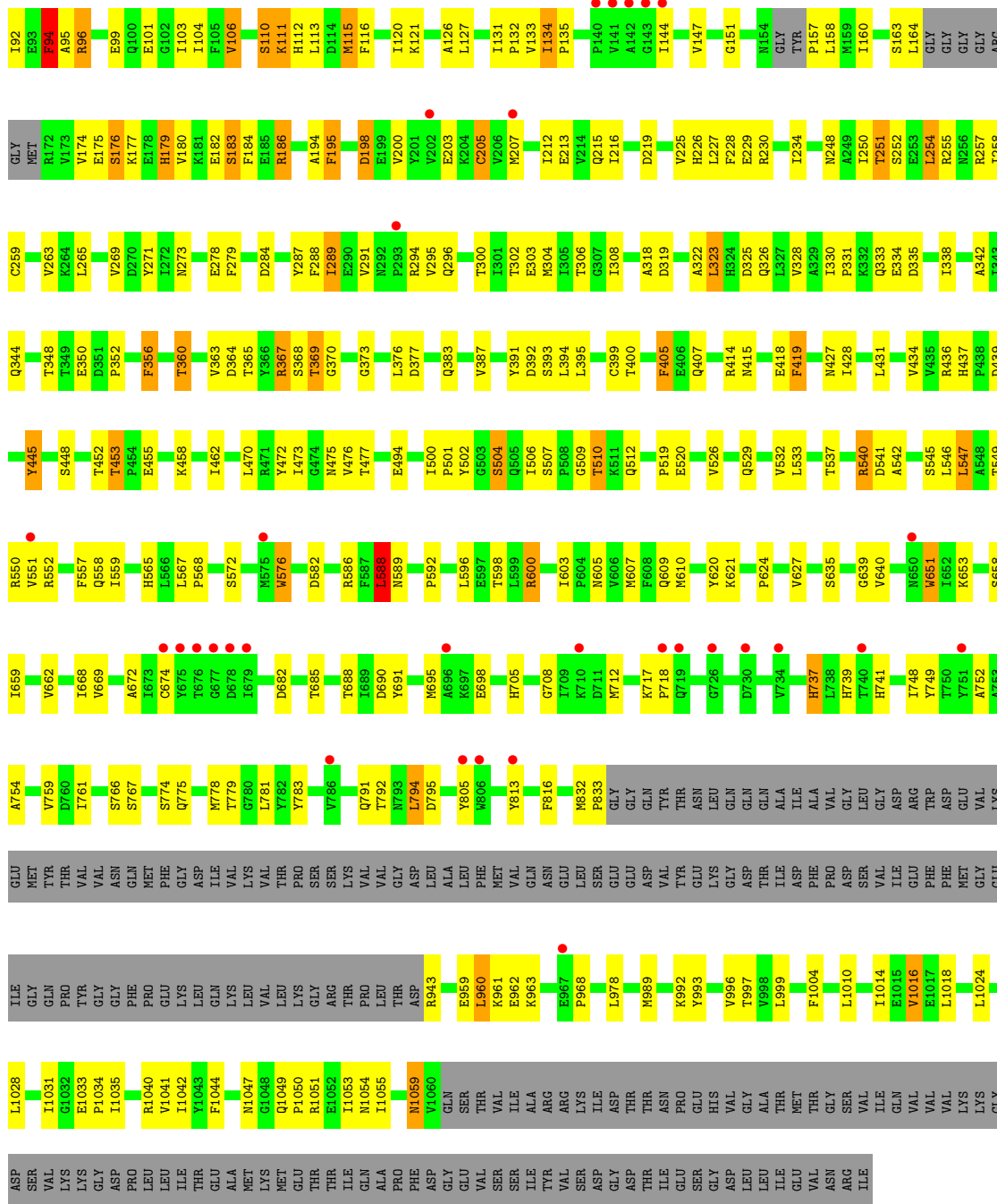
- Molecule 1: Pyruvate carboxylase



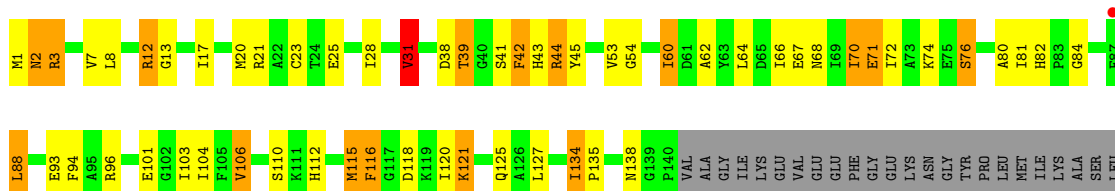


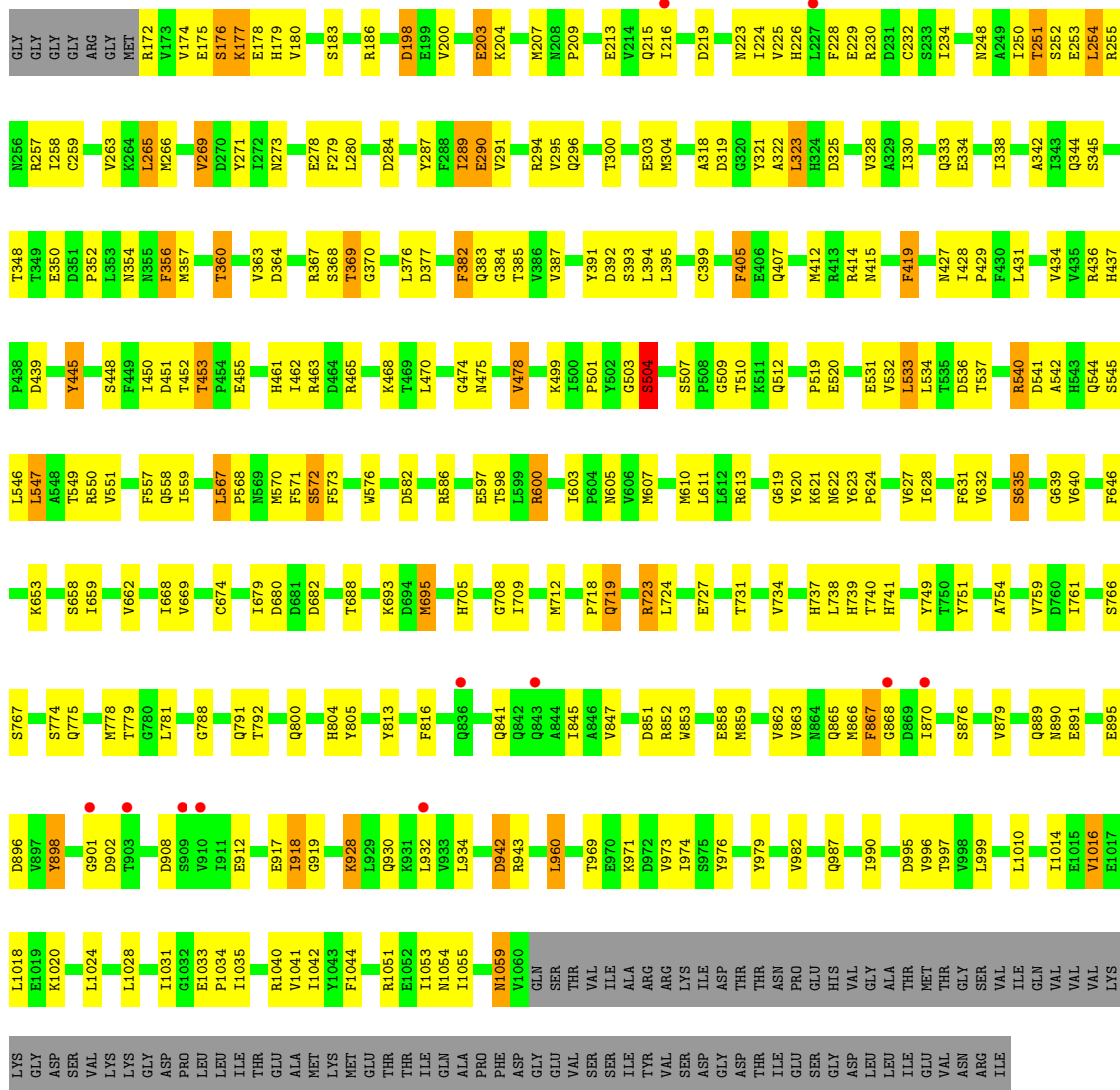
● Molecule 1: Pyruvate carboxylase



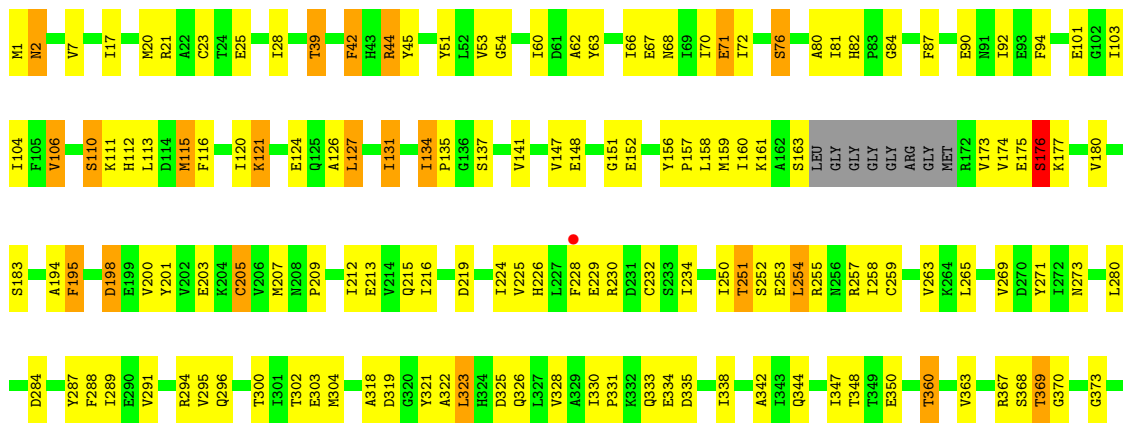


● Molecule 1: Pyruvate carboxylase





● Molecule 1: Pyruvate carboxylase



4 Data and refinement statistics i

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	91.36Å 132.62Å 257.54Å 86.65° 79.84° 70.07°	Depositor
Resolution (Å)	47.16 – 3.28 47.11 – 3.28	Depositor EDS
% Data completeness (in resolution range)	88.9 (47.16-3.28) 88.4 (47.11-3.28)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.16 (at 3.25Å)	Xtriage
Refinement program	REFMAC 5.7.0029	Depositor
R, R_{free}	0.238 , 0.284 0.235 , 0.282	Depositor DCC
R_{free} test set	7628 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	116.2	Xtriage
Anisotropy	0.062	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 86.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.398 for h,h-k,h-l 0.007 for -h,-h+k,-l 0.007 for -h,-k,-h+l	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	60495	wwPDB-VP
Average B, all atoms (Å ²)	134.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.78% 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, 0.333 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	0.46	0/8136	0.74	5/11083 (0.0%)
1	B	0.45	0/7639	0.72	7/10443 (0.1%)
1	C	0.46	0/7031	0.73	6/9586 (0.1%)
1	D	0.47	0/8042	0.74	9/10933 (0.1%)
1	E	0.45	0/7639	0.72	9/10443 (0.1%)
1	F	0.46	0/8136	0.74	6/11083 (0.1%)
1	G	0.47	0/7039	0.73	6/9597 (0.1%)
1	H	0.48	0/8042	0.74	9/10933 (0.1%)
All	All	0.46	0/61704	0.73	57/84101 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	D	0	1
1	F	0	1
1	H	0	1
All	All	0	3

There are no bond length outliers.

The worst 5 of 57 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	115	MET	CA-CB-CG	8.11	127.09	113.30
1	H	115	MET	CA-CB-CG	8.08	127.04	113.30
1	G	690	ASP	CB-CG-OD1	7.87	125.38	118.30
1	C	690	ASP	CB-CG-OD1	7.80	125.32	118.30
1	H	478	VAL	CB-CA-C	-7.79	96.61	111.40

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	504	SER	Peptide
1	F	504	SER	Peptide
1	H	504	SER	Peptide

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	7969	0	7573	289	0
1	B	7492	0	6807	324	0
1	C	6902	0	6371	288	0
1	D	7881	0	7579	288	0
1	E	7492	0	6807	311	0
1	F	7969	0	7573	299	0
1	G	6909	0	6379	282	0
1	H	7881	0	7579	298	0
All	All	60495	0	56668	2299	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 20.

The worst 5 of 2299 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:345:SER:OG	1:D:412:MET:CE	1.67	1.40
1:H:345:SER:OG	1:H:412:MET:CE	1.68	1.39
1:E:280:LEU:HD12	1:E:289:ILE:CG2	1.54	1.37
1:B:280:LEU:HD12	1:B:289:ILE:CG2	1.55	1.37
1:B:279:PHE:N	1:B:289:ILE:HD11	1.37	1.36

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	1048/1146 (91%)	988 (94%)	57 (5%)	3 (0%)	41	72
1	B	1021/1146 (89%)	966 (95%)	53 (5%)	2 (0%)	47	77
1	C	933/1146 (81%)	882 (94%)	47 (5%)	4 (0%)	34	67
1	D	1025/1146 (89%)	967 (94%)	55 (5%)	3 (0%)	41	72
1	E	1021/1146 (89%)	962 (94%)	56 (6%)	3 (0%)	41	72
1	F	1048/1146 (91%)	992 (95%)	54 (5%)	2 (0%)	47	77
1	G	934/1146 (82%)	881 (94%)	49 (5%)	4 (0%)	34	67
1	H	1025/1146 (89%)	966 (94%)	56 (6%)	3 (0%)	41	72
All	All	8055/9168 (88%)	7604 (94%)	427 (5%)	24 (0%)	41	72

5 of 24 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	H	273	ASN
1	F	273	ASN
1	E	273	ASN
1	G	176	SER
1	G	273	ASN

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	814/981 (83%)	710 (87%)	104 (13%)	4	18

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	719/981 (73%)	626 (87%)	93 (13%)	4	18
1	C	676/981 (69%)	587 (87%)	89 (13%)	4	17
1	D	819/981 (84%)	719 (88%)	100 (12%)	5	20
1	E	719/981 (73%)	625 (87%)	94 (13%)	4	18
1	F	814/981 (83%)	710 (87%)	104 (13%)	4	18
1	G	677/981 (69%)	591 (87%)	86 (13%)	4	19
1	H	819/981 (84%)	718 (88%)	101 (12%)	4	20
All	All	6057/7848 (77%)	5286 (87%)	771 (13%)	4	19

5 of 771 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	734	VAL
1	A	918	ILE
1	D	918	ILE
1	D	727	GLU
1	A	369	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 148 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	112	HIS
1	C	565	HIS
1	B	337	HIS
1	B	842	GLN
1	E	415	ASN

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](#)

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	1052/1146 (91%)	-0.22	11 (1%) 82 82	74, 124, 168, 201	0
1	B	1031/1146 (89%)	-0.13	34 (3%) 46 44	72, 153, 205, 246	0
1	C	941/1146 (82%)	-0.00	46 (4%) 29 28	72, 147, 212, 265	0
1	D	1029/1146 (89%)	-0.20	12 (1%) 79 78	58, 118, 188, 231	0
1	E	1031/1146 (89%)	-0.15	35 (3%) 45 43	68, 149, 205, 248	0
1	F	1052/1146 (91%)	-0.25	8 (0%) 86 86	72, 123, 168, 204	0
1	G	942/1146 (82%)	-0.07	32 (3%) 45 43	70, 141, 208, 267	0
1	H	1029/1146 (89%)	-0.21	7 (0%) 87 88	59, 114, 185, 232	0
All	All	8107/9168 (88%)	-0.16	185 (2%) 60 58	58, 132, 199, 267	0

The worst 5 of 185 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	675	TYR	7.6
1	C	726	GLY	6.5
1	C	675	TYR	5.9
1	E	194	ALA	5.7
1	B	194	ALA	5.6

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

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.