W O R L D W I D E
wwPDB
P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 18, 2024 – 01:35 AM EST

|		
PDB ID	:	3V9G
Title	:	Crystal structure of human 1-pyrroline-5-carboxylate dehydrogenase
Authors	:	Tanner, J.J.; Srivastava, D.
Deposited on	:	2011-12-27
Resolution	:	2.50 Å(reported)

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION
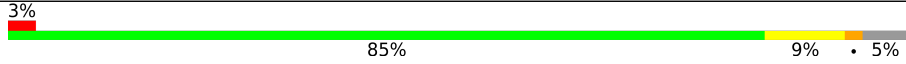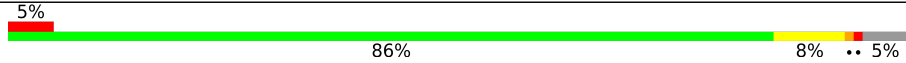
The reported resolution of this entry is 2.50 Å.

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.
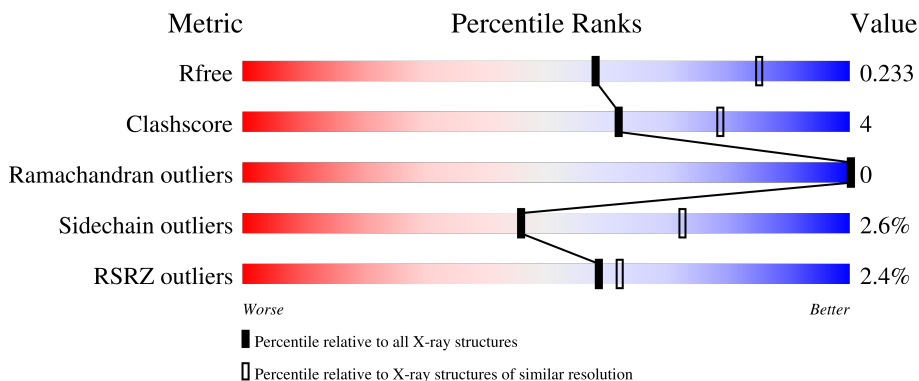
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)

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	566	
1	B	566	
1	C	566	
1	D	566	

2 Entry composition ⓘ

There is only 1 type of molecule in this entry. The entry contains 16032 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 Delta-1-pyrroline-5-carboxylate dehydrogenase, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	541	Total 4045	C 2590	N 683	O 757	S 15	0	0	0
1	B	541	Total 4033	C 2583	N 685	O 750	S 15	0	0	0
1	C	540	Total 3995	C 2566	N 671	O 743	S 15	0	0	0
1	D	540	Total 3959	C 2538	N 669	O 737	S 15	0	0	0

There are 80 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	MET	-	expression tag	UNP P30038
A	-1	GLY	-	expression tag	UNP P30038
A	0	SER	-	expression tag	UNP P30038
A	1	SER	-	expression tag	UNP P30038
A	2	HIS	-	expression tag	UNP P30038
A	3	HIS	-	expression tag	UNP P30038
A	4	HIS	-	expression tag	UNP P30038
A	5	HIS	-	expression tag	UNP P30038
A	6	HIS	-	expression tag	UNP P30038
A	7	HIS	-	expression tag	UNP P30038
A	8	SER	-	expression tag	UNP P30038
A	9	SER	-	expression tag	UNP P30038
A	10	GLY	-	expression tag	UNP P30038
A	11	LEU	-	expression tag	UNP P30038
A	12	VAL	-	expression tag	UNP P30038
A	13	PRO	-	expression tag	UNP P30038
A	14	ARG	-	expression tag	UNP P30038
A	15	GLY	-	expression tag	UNP P30038
A	16	SER	-	expression tag	UNP P30038
A	17	HIS	-	expression tag	UNP P30038
B	-2	MET	-	expression tag	UNP P30038

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	-1	GLY	-	expression tag	UNP P30038
B	0	SER	-	expression tag	UNP P30038
B	1	SER	-	expression tag	UNP P30038
B	2	HIS	-	expression tag	UNP P30038
B	3	HIS	-	expression tag	UNP P30038
B	4	HIS	-	expression tag	UNP P30038
B	5	HIS	-	expression tag	UNP P30038
B	6	HIS	-	expression tag	UNP P30038
B	7	HIS	-	expression tag	UNP P30038
B	8	SER	-	expression tag	UNP P30038
B	9	SER	-	expression tag	UNP P30038
B	10	GLY	-	expression tag	UNP P30038
B	11	LEU	-	expression tag	UNP P30038
B	12	VAL	-	expression tag	UNP P30038
B	13	PRO	-	expression tag	UNP P30038
B	14	ARG	-	expression tag	UNP P30038
B	15	GLY	-	expression tag	UNP P30038
B	16	SER	-	expression tag	UNP P30038
B	17	HIS	-	expression tag	UNP P30038
C	-2	MET	-	expression tag	UNP P30038
C	-1	GLY	-	expression tag	UNP P30038
C	0	SER	-	expression tag	UNP P30038
C	1	SER	-	expression tag	UNP P30038
C	2	HIS	-	expression tag	UNP P30038
C	3	HIS	-	expression tag	UNP P30038
C	4	HIS	-	expression tag	UNP P30038
C	5	HIS	-	expression tag	UNP P30038
C	6	HIS	-	expression tag	UNP P30038
C	7	HIS	-	expression tag	UNP P30038
C	8	SER	-	expression tag	UNP P30038
C	9	SER	-	expression tag	UNP P30038
C	10	GLY	-	expression tag	UNP P30038
C	11	LEU	-	expression tag	UNP P30038
C	12	VAL	-	expression tag	UNP P30038
C	13	PRO	-	expression tag	UNP P30038
C	14	ARG	-	expression tag	UNP P30038
C	15	GLY	-	expression tag	UNP P30038
C	16	SER	-	expression tag	UNP P30038
C	17	HIS	-	expression tag	UNP P30038
D	-2	MET	-	expression tag	UNP P30038
D	-1	GLY	-	expression tag	UNP P30038
D	0	SER	-	expression tag	UNP P30038

Continued on next page...

Continued from previous page...

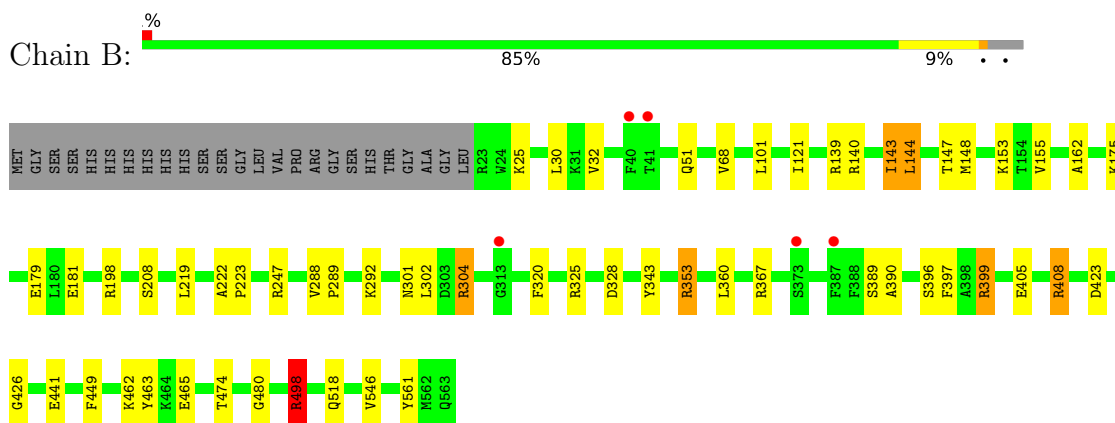| Chain	Residue	Modelled	Actual	Comment	Reference
D	1	SER	-	expression tag	UNP P30038
D	2	HIS	-	expression tag	UNP P30038
D	3	HIS	-	expression tag	UNP P30038
D	4	HIS	-	expression tag	UNP P30038
D	5	HIS	-	expression tag	UNP P30038
D	6	HIS	-	expression tag	UNP P30038
D	7	HIS	-	expression tag	UNP P30038
D	8	SER	-	expression tag	UNP P30038
D	9	SER	-	expression tag	UNP P30038
D	10	GLY	-	expression tag	UNP P30038
D	11	LEU	-	expression tag	UNP P30038
D	12	VAL	-	expression tag	UNP P30038
D	13	PRO	-	expression tag	UNP P30038
D	14	ARG	-	expression tag	UNP P30038
D	15	GLY	-	expression tag	UNP P30038
D	16	SER	-	expression tag	UNP P30038
D	17	HIS	-	expression tag	UNP P30038

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: Delta-1-pyrroline-5-carboxylate dehydrogenase, mitochondrial
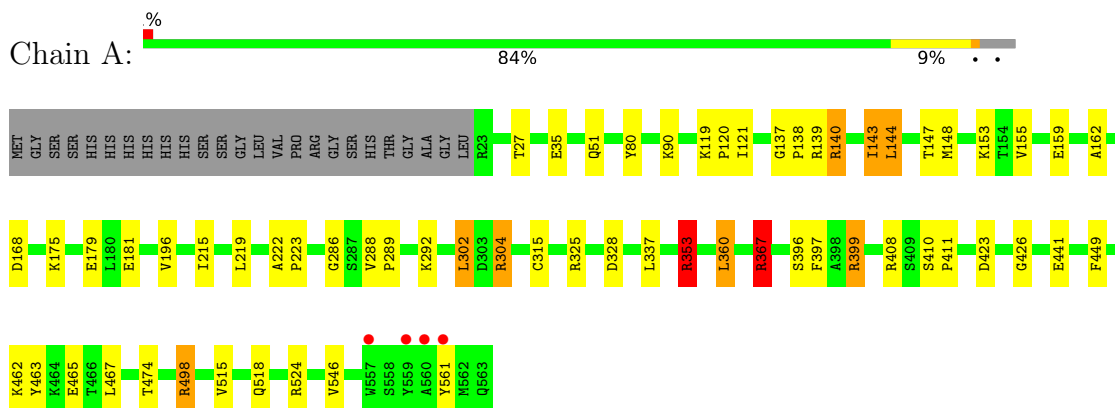
- Molecule 1: Delta-1-pyrroline-5-carboxylate dehydrogenase, mitochondrial

- Molecule 1: Delta-1-pyrroline-5-carboxylate dehydrogenase, mitochondrial

F449 Y456 K462 Y463 K464 E465 T466 L469 T474 R498 Y505 V515 Q518 R524 A525 K531 S543 V546 I547 K548 W557 S558 Y559 A560 Y561 M562 GLN
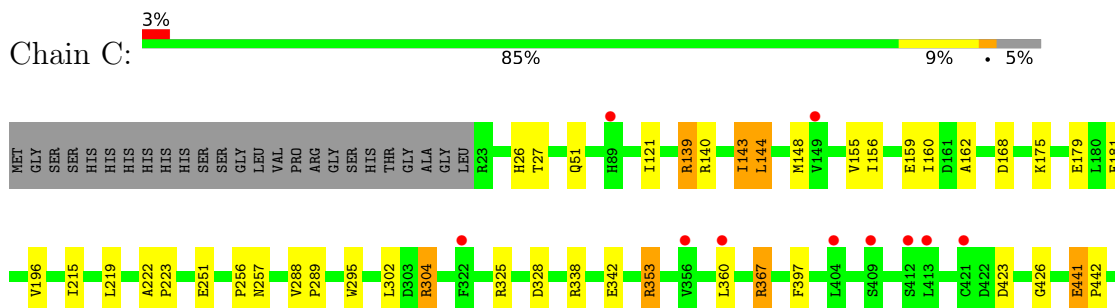
• Molecule 1: Delta-1-pyrroline-5-carboxylate dehydrogenase, mitochondrial

Chain D:

5%

86%   8%   •• 5%

MET GLY SER HIS HIS HIS HIS HIS SER SER GLY LEU VAL PRO ARG GLY SER HIS THR GLY ALA GLY LEU R23 W24 S28 S29 L30 F40 T41 L50 Q51 L57 K58 G59 S83 P84 F85 V91 I121 R139 I143 L144 M148 V149 V155 I156

E159 I160 D161 A162 K175 E179 L180 E181 V196 S208 I215 L219 A222 P223 G286 S287 V288 P289 W295 N301 L302 D303 R304 C315 F320 R325 D328 V333 L337 R353 P357 L360 I364 R367 L368 V377

A381 F397 E405 R408 S409 S410 P411 S412 L413 D423 S424 V425 G426 E441 P442 F449 T466 L467 Q468 L469 V470 T474 Q485 R498 Y505 R524 K531 H536 Y537 R540 V546 I547 K548 Y561 M562 GLN

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, α, β, γ	150.72Å 150.72Å 191.98Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	38.66 – 2.50 47.78 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.7 (38.66-2.50) 99.7 (47.78-2.50)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.81 (at 2.51Å)	Xtriage
Refinement program	PHENIX 1.7_650	Depositor
R, R_{free}	0.204 , 0.238 0.198 , 0.233	Depositor DCC
R_{free} test set	2006 reflections (2.36%)	wwPDB-VP
Wilson B-factor (Å^2)	53.4	Xtriage
Anisotropy	0.269	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 50.1	EDS
L-test for twinning [2]	$< |L| > = 0.51, < L^2 > = 0.35$	Xtriage
Estimated twinning fraction	0.027 for h,-h-k,-l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	16032	wwPDB-VP
Average B, all atoms (Å^2)	63.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.79% 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 ⓘ

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	0.47	0/4152	1.01	26/5667 (0.5%)
1	B	0.45	0/4140	0.88	22/5652 (0.4%)
1	C	0.43	0/4102	0.95	21/5607 (0.4%)
1	D	0.42	0/4064	0.79	19/5563 (0.3%)
All	All	0.44	0/16458	0.91	88/22489 (0.4%)

There are no bond length outliers.

The worst 5 of 88 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	140	ARG	NE-CZ-NH2	-23.05	108.77	120.30
1	C	139	ARG	NE-CZ-NH2	-21.12	109.74	120.30
1	A	140	ARG	NE-CZ-NH1	21.00	130.80	120.30
1	C	524	ARG	NE-CZ-NH1	-17.89	111.35	120.30
1	C	139	ARG	NE-CZ-NH1	17.51	129.05	120.30

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	4045	0	3842	42	0
1	B	4033	0	3827	38	0
1	C	3995	0	3765	40	0
1	D	3959	0	3706	45	0

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	16032	0	15140	138	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 4.

The worst 5 of 138 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:396:SER:HA	1:A:399:ARG:HH11	1.27	0.98
1:B:396:SER:HA	1:B:399:ARG:NH1	1.98	0.78
1:A:325:ARG:HA	1:A:360:LEU:HD22	1.70	0.74
1:A:396:SER:HA	1:A:399:ARG:NH1	2.05	0.70
1:A:175:LYS:O	1:A:179:GLU:HG3	1.93	0.69

There are no symmetry-related clashes.

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	539/566 (95%)	524 (97%)	15 (3%)	0	100	100
1	B	539/566 (95%)	525 (97%)	14 (3%)	0	100	100
1	C	538/566 (95%)	525 (98%)	13 (2%)	0	100	100
1	D	538/566 (95%)	523 (97%)	15 (3%)	0	100	100
All	All	2154/2264 (95%)	2097 (97%)	57 (3%)	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	408/464 (88%)	394 (97%)	14 (3%)	37	63
1	B	404/464 (87%)	396 (98%)	8 (2%)	55	79
1	C	395/464 (85%)	386 (98%)	9 (2%)	50	76
1	D	389/464 (84%)	378 (97%)	11 (3%)	43	70
All	All	1596/1856 (86%)	1554 (97%)	42 (3%)	46	72

5 of 42 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	441	GLU
1	D	144	LEU
1	C	449	PHE
1	D	30	LEU
1	D	353	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 21 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	218	ASN
1	D	103	ASN
1	D	363	GLN
1	D	173	ASN
1	D	86	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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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(Å²)	Q<0.9
1	A	541/566 (95%)	-0.22	4 (0%)	87	89	30, 49, 72, 92	0
1	B	541/566 (95%)	-0.02	5 (0%)	84	86	31, 56, 80, 97	0
1	C	540/566 (95%)	0.19	17 (3%)	49	52	43, 68, 89, 113	0
1	D	540/566 (95%)	0.25	26 (4%)	30	32	51, 78, 98, 122	0
All	All	2162/2264 (95%)	0.05	52 (2%)	59	62	30, 63, 91, 122	0

The worst 5 of 52 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	360	LEU	4.8
1	C	412	SER	4.7
1	D	155	VAL	4.5
1	D	368	LEU	4.3
1	D	149	VAL	3.9

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

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.