



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 20, 2026 – 10:20 AM UTC

PDB ID : 4HNN / pdb_00004hnn
Title : Dihydropicolinate Synthase from the common grapevine with pyruvate and lysine
Authors : Atkinson, S.C.; Dobson, R.C.J.; Perugini, M.A.
Deposited on : 2012-10-19
Resolution : 2.40 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

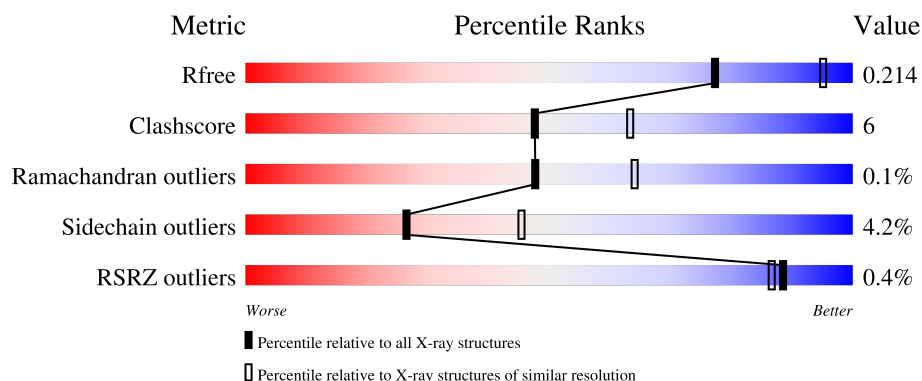
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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}	180053	4912 (2.40-2.40)
Clashscore	190562	5391 (2.40-2.40)
Ramachandran outliers	187476	5320 (2.40-2.40)
Sidechain outliers	187428	5321 (2.40-2.40)
RSRZ outliers	180081	4916 (2.40-2.40)

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	346	
1	B	346	
1	C	346	
1	D	346	
1	E	346	

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Mol	Chain	Length	Quality of chain
1	F	346	77% 14% • 8%
1	G	346	70% 16% • 11%
1	H	346	% 74% 11% • 11%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 20101 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 Dihydrodipicolinate synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	307	Total	C	N	O	S	0	0	0
			2362	1504	404	444	10			
1	B	307	Total	C	N	O	S	0	0	0
			2362	1504	404	444	10			
1	C	308	Total	C	N	O	S	0	0	0
			2369	1508	405	446	10			
1	D	308	Total	C	N	O	S	0	2	0
			2383	1518	409	446	10			
1	E	307	Total	C	N	O	S	0	1	0
			2363	1506	403	444	10			
1	F	320	Total	C	N	O	S	0	3	0
			2471	1573	423	464	11			
1	G	307	Total	C	N	O	S	0	3	0
			2376	1516	404	446	10			
1	H	308	Total	C	N	O	S	0	0	0
			2362	1505	402	445	10			

There are 160 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-18	MET	-	expression tag	UNP D7U7T8
A	-17	GLY	-	expression tag	UNP D7U7T8
A	-16	SER	-	expression tag	UNP D7U7T8
A	-15	SER	-	expression tag	UNP D7U7T8
A	-14	HIS	-	expression tag	UNP D7U7T8
A	-13	HIS	-	expression tag	UNP D7U7T8
A	-12	HIS	-	expression tag	UNP D7U7T8
A	-11	HIS	-	expression tag	UNP D7U7T8
A	-10	HIS	-	expression tag	UNP D7U7T8
A	-9	SER	-	expression tag	UNP D7U7T8
A	-8	SER	-	expression tag	UNP D7U7T8
A	-7	GLY	-	expression tag	UNP D7U7T8
A	-6	LEU	-	expression tag	UNP D7U7T8

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Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	VAL	-	expression tag	UNP D7U7T8
A	-4	PRO	-	expression tag	UNP D7U7T8
A	-3	ARG	-	expression tag	UNP D7U7T8
A	-2	GLY	-	expression tag	UNP D7U7T8
A	-1	SER	-	expression tag	UNP D7U7T8
A	0	HIS	-	expression tag	UNP D7U7T8
A	1	MET	-	expression tag	UNP D7U7T8
B	-18	MET	-	expression tag	UNP D7U7T8
B	-17	GLY	-	expression tag	UNP D7U7T8
B	-16	SER	-	expression tag	UNP D7U7T8
B	-15	SER	-	expression tag	UNP D7U7T8
B	-14	HIS	-	expression tag	UNP D7U7T8
B	-13	HIS	-	expression tag	UNP D7U7T8
B	-12	HIS	-	expression tag	UNP D7U7T8
B	-11	HIS	-	expression tag	UNP D7U7T8
B	-10	HIS	-	expression tag	UNP D7U7T8
B	-9	SER	-	expression tag	UNP D7U7T8
B	-8	SER	-	expression tag	UNP D7U7T8
B	-7	GLY	-	expression tag	UNP D7U7T8
B	-6	LEU	-	expression tag	UNP D7U7T8
B	-5	VAL	-	expression tag	UNP D7U7T8
B	-4	PRO	-	expression tag	UNP D7U7T8
B	-3	ARG	-	expression tag	UNP D7U7T8
B	-2	GLY	-	expression tag	UNP D7U7T8
B	-1	SER	-	expression tag	UNP D7U7T8
B	0	HIS	-	expression tag	UNP D7U7T8
B	1	MET	-	expression tag	UNP D7U7T8
C	-18	MET	-	expression tag	UNP D7U7T8
C	-17	GLY	-	expression tag	UNP D7U7T8
C	-16	SER	-	expression tag	UNP D7U7T8
C	-15	SER	-	expression tag	UNP D7U7T8
C	-14	HIS	-	expression tag	UNP D7U7T8
C	-13	HIS	-	expression tag	UNP D7U7T8
C	-12	HIS	-	expression tag	UNP D7U7T8
C	-11	HIS	-	expression tag	UNP D7U7T8
C	-10	HIS	-	expression tag	UNP D7U7T8
C	-9	SER	-	expression tag	UNP D7U7T8
C	-8	SER	-	expression tag	UNP D7U7T8
C	-7	GLY	-	expression tag	UNP D7U7T8
C	-6	LEU	-	expression tag	UNP D7U7T8
C	-5	VAL	-	expression tag	UNP D7U7T8
C	-4	PRO	-	expression tag	UNP D7U7T8

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-3	ARG	-	expression tag	UNP D7U7T8
C	-2	GLY	-	expression tag	UNP D7U7T8
C	-1	SER	-	expression tag	UNP D7U7T8
C	0	HIS	-	expression tag	UNP D7U7T8
C	1	MET	-	expression tag	UNP D7U7T8
D	-18	MET	-	expression tag	UNP D7U7T8
D	-17	GLY	-	expression tag	UNP D7U7T8
D	-16	SER	-	expression tag	UNP D7U7T8
D	-15	SER	-	expression tag	UNP D7U7T8
D	-14	HIS	-	expression tag	UNP D7U7T8
D	-13	HIS	-	expression tag	UNP D7U7T8
D	-12	HIS	-	expression tag	UNP D7U7T8
D	-11	HIS	-	expression tag	UNP D7U7T8
D	-10	HIS	-	expression tag	UNP D7U7T8
D	-9	SER	-	expression tag	UNP D7U7T8
D	-8	SER	-	expression tag	UNP D7U7T8
D	-7	GLY	-	expression tag	UNP D7U7T8
D	-6	LEU	-	expression tag	UNP D7U7T8
D	-5	VAL	-	expression tag	UNP D7U7T8
D	-4	PRO	-	expression tag	UNP D7U7T8
D	-3	ARG	-	expression tag	UNP D7U7T8
D	-2	GLY	-	expression tag	UNP D7U7T8
D	-1	SER	-	expression tag	UNP D7U7T8
D	0	HIS	-	expression tag	UNP D7U7T8
D	1	MET	-	expression tag	UNP D7U7T8
E	-18	MET	-	expression tag	UNP D7U7T8
E	-17	GLY	-	expression tag	UNP D7U7T8
E	-16	SER	-	expression tag	UNP D7U7T8
E	-15	SER	-	expression tag	UNP D7U7T8
E	-14	HIS	-	expression tag	UNP D7U7T8
E	-13	HIS	-	expression tag	UNP D7U7T8
E	-12	HIS	-	expression tag	UNP D7U7T8
E	-11	HIS	-	expression tag	UNP D7U7T8
E	-10	HIS	-	expression tag	UNP D7U7T8
E	-9	SER	-	expression tag	UNP D7U7T8
E	-8	SER	-	expression tag	UNP D7U7T8
E	-7	GLY	-	expression tag	UNP D7U7T8
E	-6	LEU	-	expression tag	UNP D7U7T8
E	-5	VAL	-	expression tag	UNP D7U7T8
E	-4	PRO	-	expression tag	UNP D7U7T8
E	-3	ARG	-	expression tag	UNP D7U7T8
E	-2	GLY	-	expression tag	UNP D7U7T8

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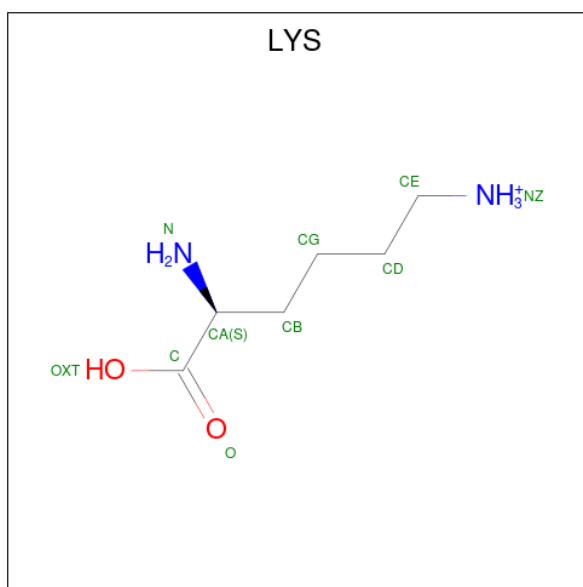
Chain	Residue	Modelled	Actual	Comment	Reference
E	-1	SER	-	expression tag	UNP D7U7T8
E	0	HIS	-	expression tag	UNP D7U7T8
E	1	MET	-	expression tag	UNP D7U7T8
F	-18	MET	-	expression tag	UNP D7U7T8
F	-17	GLY	-	expression tag	UNP D7U7T8
F	-16	SER	-	expression tag	UNP D7U7T8
F	-15	SER	-	expression tag	UNP D7U7T8
F	-14	HIS	-	expression tag	UNP D7U7T8
F	-13	HIS	-	expression tag	UNP D7U7T8
F	-12	HIS	-	expression tag	UNP D7U7T8
F	-11	HIS	-	expression tag	UNP D7U7T8
F	-10	HIS	-	expression tag	UNP D7U7T8
F	-9	SER	-	expression tag	UNP D7U7T8
F	-8	SER	-	expression tag	UNP D7U7T8
F	-7	GLY	-	expression tag	UNP D7U7T8
F	-6	LEU	-	expression tag	UNP D7U7T8
F	-5	VAL	-	expression tag	UNP D7U7T8
F	-4	PRO	-	expression tag	UNP D7U7T8
F	-3	ARG	-	expression tag	UNP D7U7T8
F	-2	GLY	-	expression tag	UNP D7U7T8
F	-1	SER	-	expression tag	UNP D7U7T8
F	0	HIS	-	expression tag	UNP D7U7T8
F	1	MET	-	expression tag	UNP D7U7T8
G	-18	MET	-	expression tag	UNP D7U7T8
G	-17	GLY	-	expression tag	UNP D7U7T8
G	-16	SER	-	expression tag	UNP D7U7T8
G	-15	SER	-	expression tag	UNP D7U7T8
G	-14	HIS	-	expression tag	UNP D7U7T8
G	-13	HIS	-	expression tag	UNP D7U7T8
G	-12	HIS	-	expression tag	UNP D7U7T8
G	-11	HIS	-	expression tag	UNP D7U7T8
G	-10	HIS	-	expression tag	UNP D7U7T8
G	-9	SER	-	expression tag	UNP D7U7T8
G	-8	SER	-	expression tag	UNP D7U7T8
G	-7	GLY	-	expression tag	UNP D7U7T8
G	-6	LEU	-	expression tag	UNP D7U7T8
G	-5	VAL	-	expression tag	UNP D7U7T8
G	-4	PRO	-	expression tag	UNP D7U7T8
G	-3	ARG	-	expression tag	UNP D7U7T8
G	-2	GLY	-	expression tag	UNP D7U7T8
G	-1	SER	-	expression tag	UNP D7U7T8
G	0	HIS	-	expression tag	UNP D7U7T8

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Chain	Residue	Modelled	Actual	Comment	Reference
G	1	MET	-	expression tag	UNP D7U7T8
H	-18	MET	-	expression tag	UNP D7U7T8
H	-17	GLY	-	expression tag	UNP D7U7T8
H	-16	SER	-	expression tag	UNP D7U7T8
H	-15	SER	-	expression tag	UNP D7U7T8
H	-14	HIS	-	expression tag	UNP D7U7T8
H	-13	HIS	-	expression tag	UNP D7U7T8
H	-12	HIS	-	expression tag	UNP D7U7T8
H	-11	HIS	-	expression tag	UNP D7U7T8
H	-10	HIS	-	expression tag	UNP D7U7T8
H	-9	SER	-	expression tag	UNP D7U7T8
H	-8	SER	-	expression tag	UNP D7U7T8
H	-7	GLY	-	expression tag	UNP D7U7T8
H	-6	LEU	-	expression tag	UNP D7U7T8
H	-5	VAL	-	expression tag	UNP D7U7T8
H	-4	PRO	-	expression tag	UNP D7U7T8
H	-3	ARG	-	expression tag	UNP D7U7T8
H	-2	GLY	-	expression tag	UNP D7U7T8
H	-1	SER	-	expression tag	UNP D7U7T8
H	0	HIS	-	expression tag	UNP D7U7T8
H	1	MET	-	expression tag	UNP D7U7T8

- Molecule 2 is LYSINE (CCD ID: LYS) (formula: $C_6H_{15}N_2O_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			10	6	2	2		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	B	1	Total	C	N	O	0	0
			10	6	2	2		
2	C	1	Total	C	N	O	0	0
			10	6	2	2		
2	D	1	Total	C	N	O	0	0
			10	6	2	2		
2	E	1	Total	C	N	O	0	0
			10	6	2	2		
2	F	1	Total	C	N	O	0	0
			10	6	2	2		
2	G	1	Total	C	N	O	0	0
			10	6	2	2		
2	H	1	Total	C	N	O	0	0
			10	6	2	2		

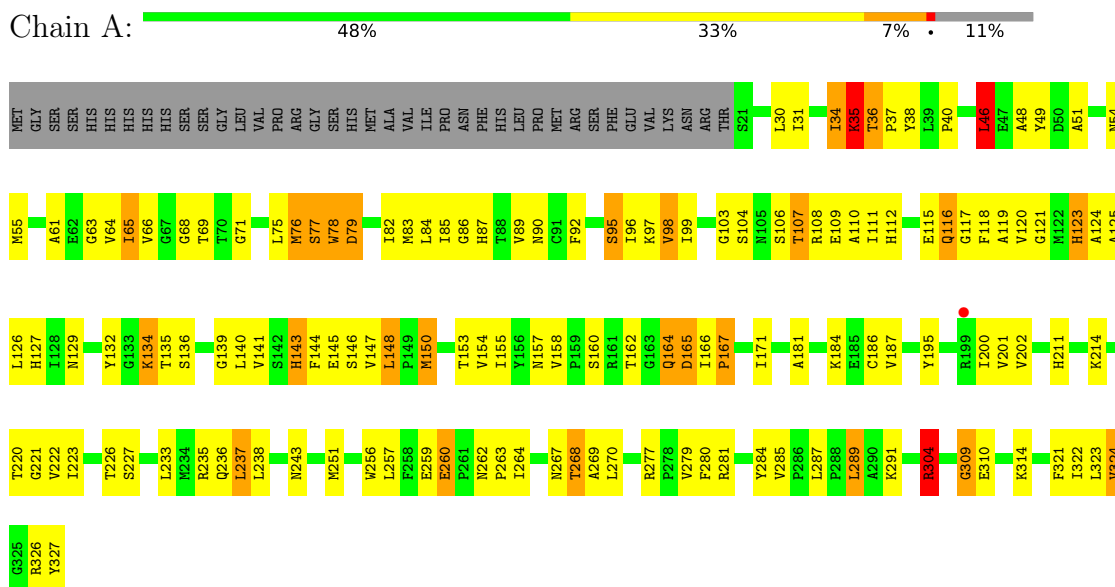
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	130	Total	O	0	0
			130	130		
3	B	142	Total	O	0	0
			142	142		
3	C	159	Total	O	0	0
			159	159		
3	D	140	Total	O	0	0
			140	140		
3	E	102	Total	O	0	0
			102	102		
3	F	119	Total	O	0	0
			119	119		
3	G	84	Total	O	0	0
			84	84		
3	H	97	Total	O	0	0
			97	97		

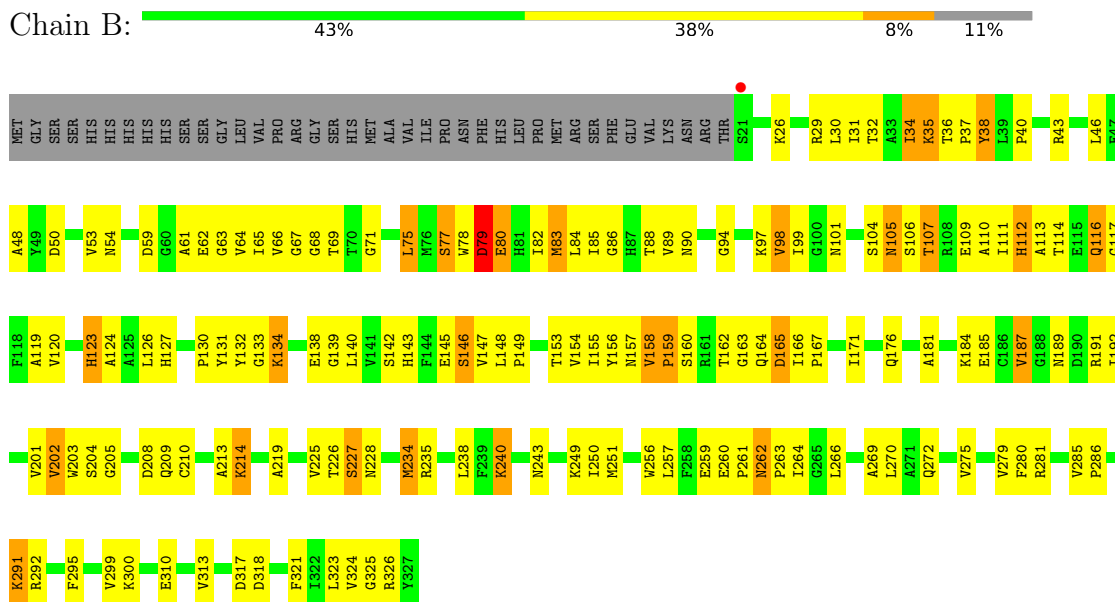
3 Residue-property plots

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: Dihydrodipicolinate synthase

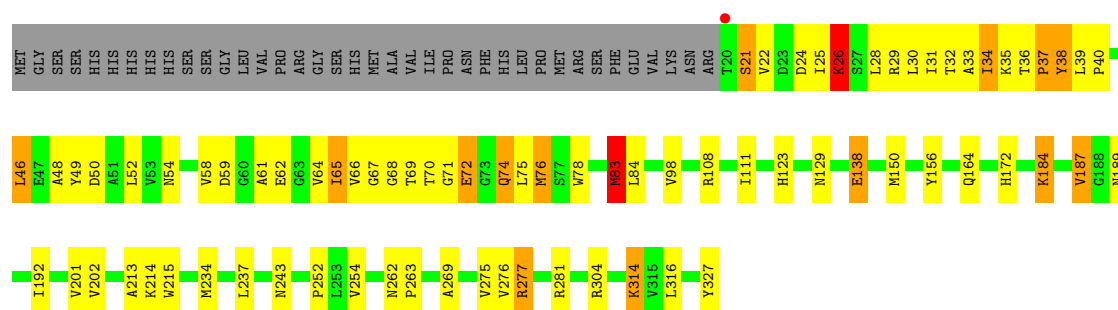


• Molecule 1: Dihydrodipicolinate synthase



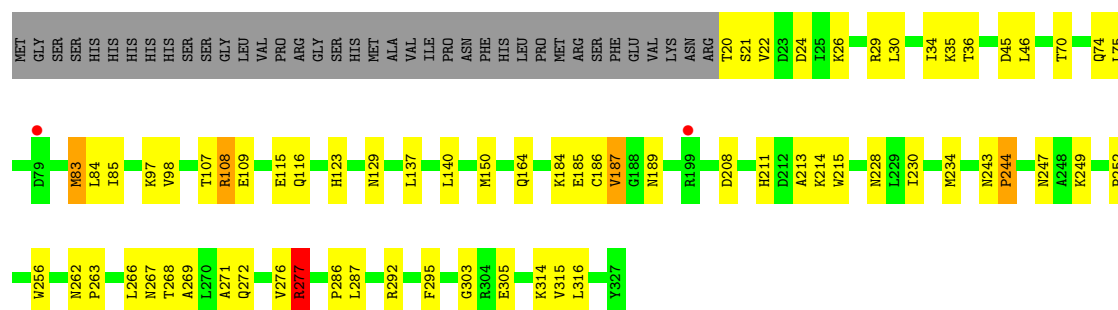
- Molecule 1: Dihydrodipicolinate synthase

Chain C:  66% 18% 11%



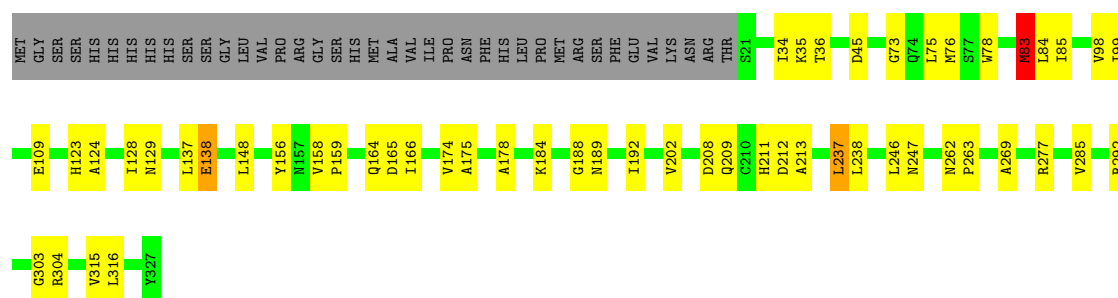
- Molecule 1: Dihydrodipicolinate synthase

Chain D:  69% 18% 11%



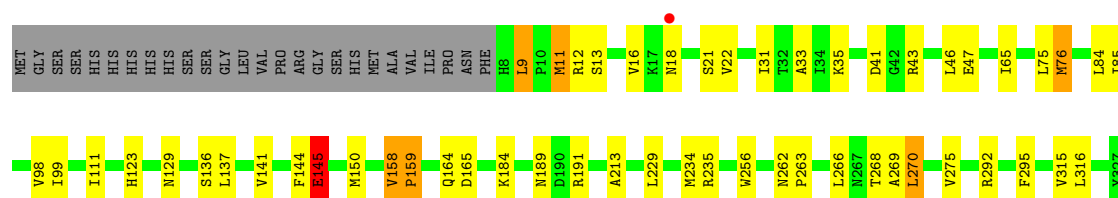
- Molecule 1: Dihydrodipicolinate synthase

Chain E:  73% 15% 11%



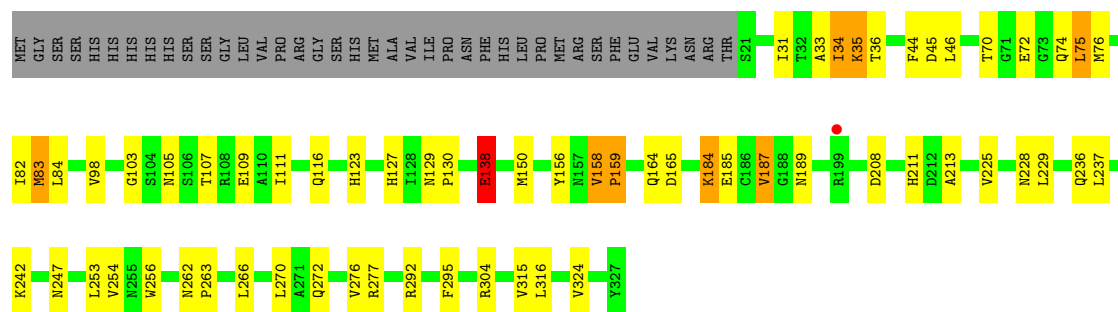
- Molecule 1: Dihydrodipicolinate synthase

Chain F:  77% 14% 8%



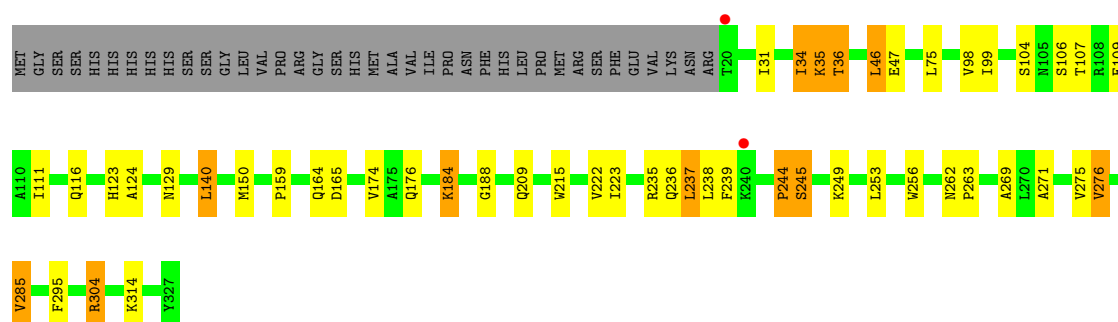
- Molecule 1: Dihydrodipicolinate synthase

Chain G:  70% 16% 11%



- Molecule 1: Dihydrodipicolinate synthase

Chain H:  74% 11% 11%



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	220.61Å 137.93Å 133.94Å 90.00° 108.25° 90.00°	Depositor
Resolution (Å)	127.20 – 2.40 127.20 – 2.40	Depositor EDS
% Data completeness (in resolution range)	98.4 (127.20-2.40) 98.4 (127.20-2.40)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.59 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.181 , 0.216 0.182 , 0.214	Depositor DCC
R_{free} test set	2020 reflections (1.36%)	wwPDB-VP
Wilson B-factor (Å ²)	25.2	Xtriage
Anisotropy	0.099	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 28.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	20101	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 2.75% 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 ⓘ

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

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	2.39	111/2398 (4.6%)	1.19	6/3263 (0.2%)
1	B	2.50	131/2398 (5.5%)	1.29	11/3263 (0.3%)
1	C	1.47	51/2405 (2.1%)	0.99	1/3273 (0.0%)
1	D	1.23	30/2427 (1.2%)	0.93	1/3303 (0.0%)
1	E	1.16	12/2403 (0.5%)	0.89	2/3271 (0.1%)
1	F	1.14	21/2519 (0.8%)	0.91	0/3428
1	G	1.17	18/2423 (0.7%)	0.91	3/3298 (0.1%)
1	H	1.12	15/2398 (0.6%)	0.90	1/3264 (0.0%)
All	All	1.61	389/19371 (2.0%)	1.01	25/26363 (0.1%)

The worst 5 of 389 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	G	138[A]	GLU	N-CA	-12.24	1.30	1.46
1	G	138[B]	GLU	N-CA	-12.24	1.30	1.46
1	B	285	VAL	C-O	-9.47	1.17	1.24
1	A	167	PRO	C-O	-8.31	1.17	1.24
1	G	109	GLU	C-O	-8.27	1.14	1.24

The worst 5 of 25 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	227	SER	N-CA-C	6.62	120.23	111.75
1	H	244	PRO	N-CA-C	-6.39	101.17	111.14
1	A	134	LYS	N-CA-C	6.00	119.18	110.42
1	D	108	ARG	N-CA-C	6.00	117.49	111.07
1	C	34	ILE	N-CA-C	5.77	116.52	109.30

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	2362	0	2355	36	0
1	B	2362	0	2354	21	0
1	C	2369	0	2361	29	0
1	D	2383	0	2376	30	0
1	E	2363	0	2350	31	0
1	F	2471	0	2456	24	0
1	G	2376	0	2360	32	0
1	H	2362	0	2344	25	0
2	A	10	0	12	3	0
2	B	10	0	12	0	0
2	C	10	0	12	2	0
2	D	10	0	12	0	0
2	E	10	0	12	3	0
2	F	10	0	12	1	0
2	G	10	0	12	0	0
2	H	10	0	12	0	0
3	A	130	0	0	2	0
3	B	142	0	0	0	0
3	C	159	0	0	2	0
3	D	140	0	0	1	0
3	E	102	0	0	0	0
3	F	119	0	0	0	0
3	G	84	0	0	0	0
3	H	97	0	0	0	0
All	All	20101	0	19052	215	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 6.

The worst 5 of 215 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:98:VAL:H	1:A:123:HIS:HD2	1.04	1.00
1:B:98:VAL:H	1:B:123:HIS:HD2	1.09	0.99
1:C:98:VAL:H	1:C:123:HIS:HD2	1.02	0.99

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:98:VAL:H	1:E:123:HIS:HD2	1.03	0.98
1:G:98:VAL:H	1:G:123:HIS:HD2	1.12	0.97

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	304/346 (88%)	298 (98%)	6 (2%)	0	100	100
1	B	304/346 (88%)	300 (99%)	3 (1%)	1 (0%)	36	50
1	C	305/346 (88%)	302 (99%)	3 (1%)	0	100	100
1	D	307/346 (89%)	301 (98%)	6 (2%)	0	100	100
1	E	305/346 (88%)	300 (98%)	5 (2%)	0	100	100
1	F	320/346 (92%)	315 (98%)	5 (2%)	0	100	100
1	G	307/346 (89%)	303 (99%)	4 (1%)	0	100	100
1	H	305/346 (88%)	298 (98%)	6 (2%)	1 (0%)	36	50
All	All	2457/2768 (89%)	2417 (98%)	38 (2%)	2 (0%)	48	64

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	H	245	SER
1	B	79	ASP

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	257/292 (88%)	237 (92%)	20 (8%)	11	20
1	B	257/292 (88%)	244 (95%)	13 (5%)	21	37
1	C	258/292 (88%)	247 (96%)	11 (4%)	26	44
1	D	260/292 (89%)	251 (96%)	9 (4%)	32	53
1	E	257/292 (88%)	250 (97%)	7 (3%)	39	62
1	F	269/292 (92%)	263 (98%)	6 (2%)	45	67
1	G	258/292 (88%)	247 (96%)	11 (4%)	26	44
1	H	255/292 (87%)	245 (96%)	10 (4%)	28	48
All	All	2071/2336 (89%)	1984 (96%)	87 (4%)	26	45

5 of 87 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	138	GLU
1	G	187	VAL
1	E	285	VAL
1	F	270	LEU
1	G	242	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 74 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	306	ASN
1	H	236	GLN
1	G	116	GLN
1	H	123	HIS
1	C	306	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

8 non-standard protein/DNA/RNA residues 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$
1	KPI	H	184	1	11,13,14	1.81	2 (18%)	9,15,17	1.89	5 (55%)
1	KPI	D	184	1	11,13,14	1.65	2 (18%)	9,15,17	1.95	4 (44%)
1	KPI	B	184	1	11,13,14	2.17	2 (18%)	9,15,17	1.60	4 (44%)
1	KPI	C	184	1	11,13,14	2.44	3 (27%)	9,15,17	1.31	1 (11%)
1	KPI	E	184	1	11,13,14	2.13	2 (18%)	9,15,17	1.74	3 (33%)
1	KPI	G	184	1	11,13,14	1.83	2 (18%)	9,15,17	2.25	4 (44%)
1	KPI	A	184	1	11,13,14	2.27	3 (27%)	9,15,17	1.31	1 (11%)
1	KPI	F	184	1	11,13,14	2.10	3 (27%)	9,15,17	1.96	5 (55%)

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
1	KPI	H	184	1	-	1/13/14/16	-
1	KPI	D	184	1	-	2/13/14/16	-
1	KPI	B	184	1	-	1/13/14/16	-
1	KPI	C	184	1	-	1/13/14/16	-
1	KPI	E	184	1	-	1/13/14/16	-
1	KPI	G	184	1	-	0/13/14/16	-
1	KPI	A	184	1	-	1/13/14/16	-
1	KPI	F	184	1	-	1/13/14/16	-

The worst 5 of 19 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	184	KPI	CX2-CX1	-5.94	1.42	1.49
1	A	184	KPI	CX2-CX1	-5.25	1.43	1.49
1	E	184	KPI	CX2-CX1	-5.01	1.44	1.49
1	B	184	KPI	CX2-CX1	-4.86	1.44	1.49
1	F	184	KPI	CX2-CX1	-4.52	1.44	1.49

The worst 5 of 27 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	184	KPI	CE-NZ-CX1	3.48	131.14	121.58
1	G	184	KPI	O2-CX2-CX1	-3.37	117.23	121.35
1	G	184	KPI	O1-CX2-CX1	3.32	123.56	116.50
1	G	184	KPI	CE-NZ-CX1	3.14	130.21	121.58
1	E	184	KPI	CX2-CX1-NZ	3.03	122.02	114.88

There are no chirality outliers.

5 of 8 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	184	KPI	O-C-CA-CB
1	B	184	KPI	O-C-CA-CB
1	C	184	KPI	O-C-CA-CB
1	D	184	KPI	O-C-CA-CB
1	E	184	KPI	O-C-CA-CB

There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	H	184	KPI	1	0
1	C	184	KPI	1	0
1	G	184	KPI	1	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

8 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	LYS	F	401	-	8,9,9	0.86	1 (12%)	7,10,10	1.01	1 (14%)
2	LYS	C	401	-	8,9,9	0.79	1 (12%)	7,10,10	1.40	1 (14%)
2	LYS	A	401	-	8,9,9	0.86	1 (12%)	7,10,10	1.22	1 (14%)
2	LYS	H	401	-	8,9,9	0.92	1 (12%)	7,10,10	1.26	1 (14%)
2	LYS	B	401	-	8,9,9	0.82	0	7,10,10	1.06	1 (14%)
2	LYS	E	401	-	8,9,9	0.84	0	7,10,10	1.15	1 (14%)
2	LYS	G	401	-	8,9,9	0.83	1 (12%)	7,10,10	1.09	1 (14%)
2	LYS	D	401	-	8,9,9	0.91	1 (12%)	7,10,10	1.22	1 (14%)

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	LYS	F	401	-	-	1/9/9/9	-
2	LYS	C	401	-	-	3/9/9/9	-
2	LYS	A	401	-	-	1/9/9/9	-
2	LYS	H	401	-	-	0/9/9/9	-
2	LYS	B	401	-	-	0/9/9/9	-
2	LYS	E	401	-	-	1/9/9/9	-
2	LYS	G	401	-	-	0/9/9/9	-
2	LYS	D	401	-	-	0/9/9/9	-

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	LYS	OXT-C	-2.12	1.23	1.30
2	D	401	LYS	OXT-C	-2.11	1.23	1.30
2	H	401	LYS	OXT-C	-2.11	1.23	1.30
2	G	401	LYS	OXT-C	-2.10	1.24	1.30
2	C	401	LYS	OXT-C	-2.08	1.24	1.30

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	H	401	LYS	OXT-C-O	-2.96	117.37	124.08
2	C	401	LYS	OXT-C-O	-2.80	117.74	124.08
2	A	401	LYS	OXT-C-O	-2.74	117.86	124.08
2	D	401	LYS	OXT-C-O	-2.72	117.92	124.08

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	E	401	LYS	OXT-C-O	-2.64	118.09	124.08

There are no chirality outliers.

5 of 6 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	401	LYS	C-CA-CB-CG
2	E	401	LYS	CG-CD-CE-NZ
2	C	401	LYS	CE-CD-CG-CB
2	F	401	LYS	CE-CD-CG-CB
2	C	401	LYS	OXT-C-CA-N

There are no ring outliers.

4 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	F	401	LYS	1	0
2	C	401	LYS	2	0
2	A	401	LYS	3	0
2	E	401	LYS	3	0

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	306/346 (88%)	-0.34	1 (0%) 90 88	13, 23, 35, 44	0
1	B	306/346 (88%)	-0.43	1 (0%) 90 88	13, 20, 30, 41	0
1	C	307/346 (88%)	-0.57	1 (0%) 90 88	11, 17, 28, 38	0
1	D	307/346 (88%)	-0.47	2 (0%) 84 81	10, 19, 29, 39	2 (0%)
1	E	306/346 (88%)	-0.26	0 100 100	16, 25, 38, 43	1 (0%)
1	F	319/346 (92%)	-0.22	1 (0%) 90 88	11, 23, 41, 55	3 (0%)
1	G	306/346 (88%)	-0.14	1 (0%) 90 88	11, 27, 43, 50	3 (0%)
1	H	307/346 (88%)	-0.18	2 (0%) 84 81	14, 26, 41, 47	0
All	All	2464/2768 (89%)	-0.32	9 (0%) 88 86	10, 22, 39, 55	9 (0%)

The worst 5 of 9 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	H	20	THR	3.4
1	A	199	ARG	3.0
1	C	20	THR	2.4
1	D	199	ARG	2.3
1	F	18	ASN	2.2

6.2 Non-standard residues in protein, DNA, RNA chains [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
1	KPI	A	184	14/15	0.94	0.08	20,21,22,23	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
1	KPI	D	184	14/15	0.94	0.09	16,18,23,23	0
1	KPI	G	184	14/15	0.94	0.09	21,23,26,28	0
1	KPI	H	184	14/15	0.94	0.09	24,24,29,30	0
1	KPI	B	184	14/15	0.95	0.08	18,19,21,22	0
1	KPI	E	184	14/15	0.95	0.08	19,21,25,27	0
1	KPI	C	184	14/15	0.96	0.07	10,11,17,20	0
1	KPI	F	184	14/15	0.96	0.07	16,20,26,26	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides 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($\text{\AA}^2$)	Q<0.9
2	LYS	H	401	10/10	0.92	0.11	16,19,20,20	0
2	LYS	F	401	10/10	0.93	0.10	19,21,21,21	0
2	LYS	A	401	10/10	0.94	0.09	16,17,17,17	0
2	LYS	E	401	10/10	0.95	0.08	21,22,22,22	0
2	LYS	B	401	10/10	0.95	0.09	17,20,21,21	0
2	LYS	C	401	10/10	0.95	0.08	11,15,15,16	0
2	LYS	D	401	10/10	0.96	0.08	17,19,19,19	0
2	LYS	G	401	10/10	0.97	0.06	17,18,18,19	0

6.5 Other polymers [i](#)

There are no such residues in this entry.