wwPDB X-ray Structure Validation Summary Report (i)

Oct 31, 2026 – 09:06 am GMT

PDB ID	:	34LT / pdb_000034lt
Title	:	Trp-7-Hal - Consensus designed artificial tryptophan-7-halogenase
Authors	:	Richmond, D.T.; Crow, A.
Deposited on	:	2026-09-21
Resolution	:	2.50 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:

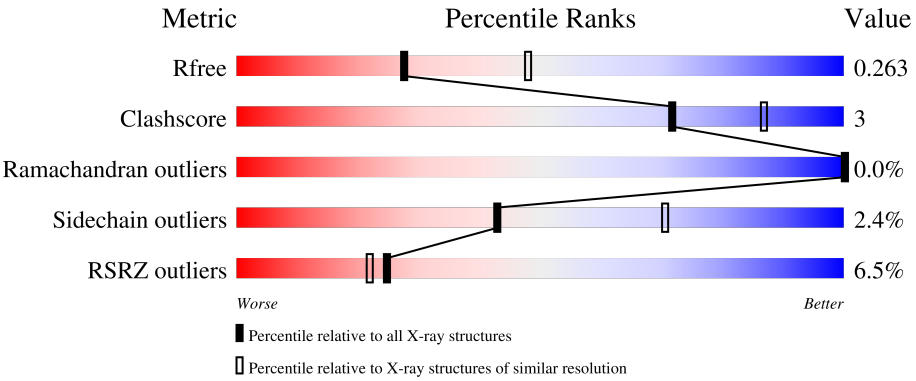
MolProbity	:	4-5-2 with Phenix2.2
Xtriage (Phenix)	:	2.2
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.51

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 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}	180053	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (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	540	4% 87% 9%
1	B	540	6% 87% 9%
1	C	540	6% 86% 9%
1	D	540	9% 85% 11%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 17066 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 Trp-7-FDH.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	B	524	Total	C	N	O	S	0	0	0
			4218	2694	725	782	17			
1	C	523	Total	C	N	O	S	0	0	0
			4210	2690	724	779	17			
1	D	523	Total	C	N	O	S	0	0	0
			4210	2688	724	781	17			
1	A	521	Total	C	N	O	S	0	0	0
			4199	2681	722	779	17			

- Molecule 2 is water.

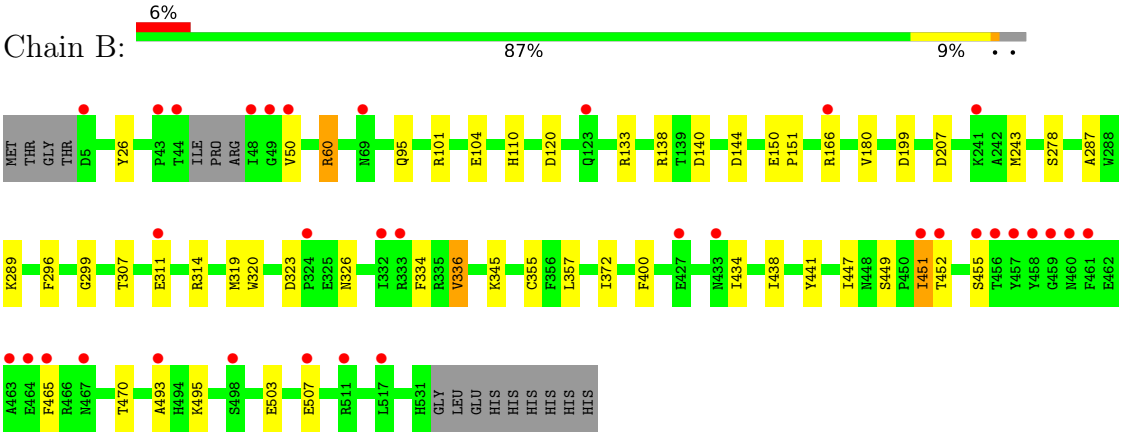
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	46	Total	O	0	0
			46	46		
2	C	68	Total	O	0	0
			68	68		
2	D	41	Total	O	0	0
			41	41		
2	A	74	Total	O	0	0
			74	74		

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.

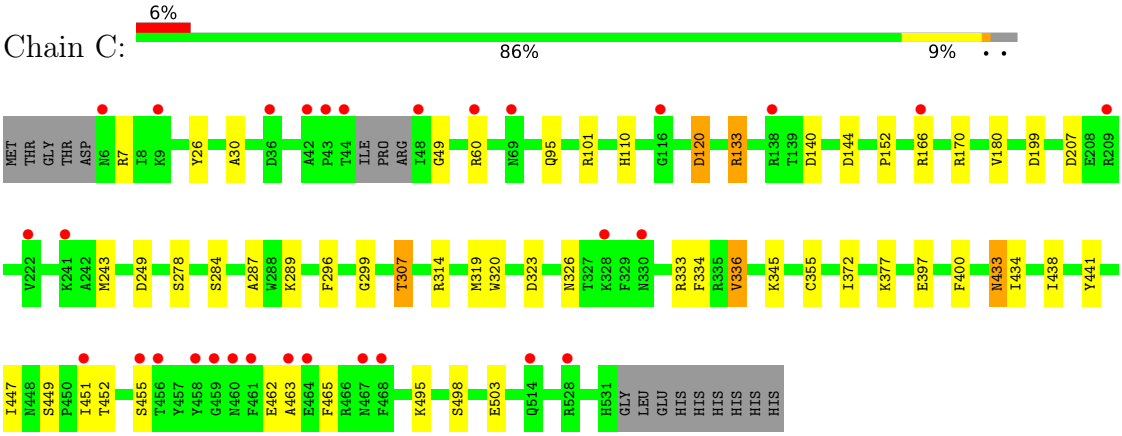
• Molecule 1: Trp-7-FDH

Chain B:



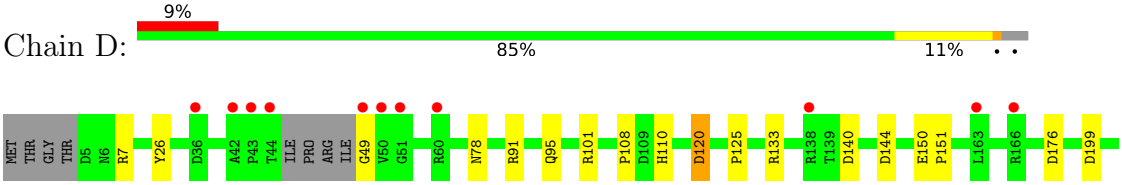
• Molecule 1: Trp-7-FDH

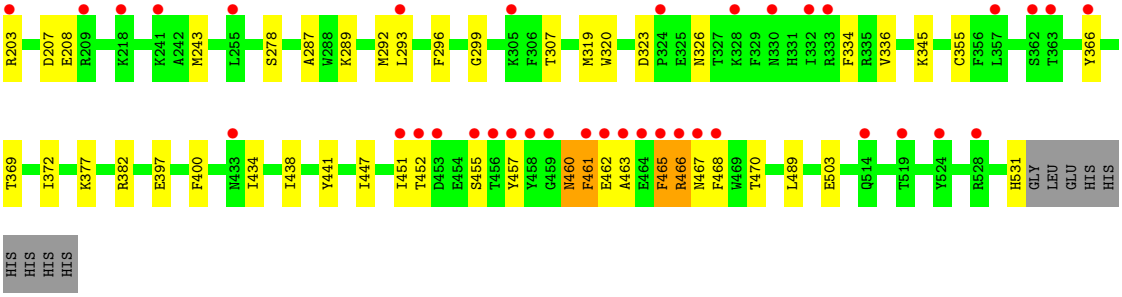
Chain C:



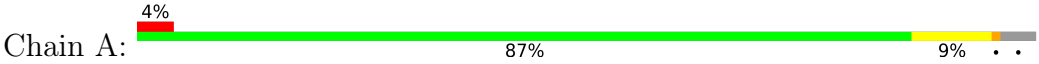
• Molecule 1: Trp-7-FDH

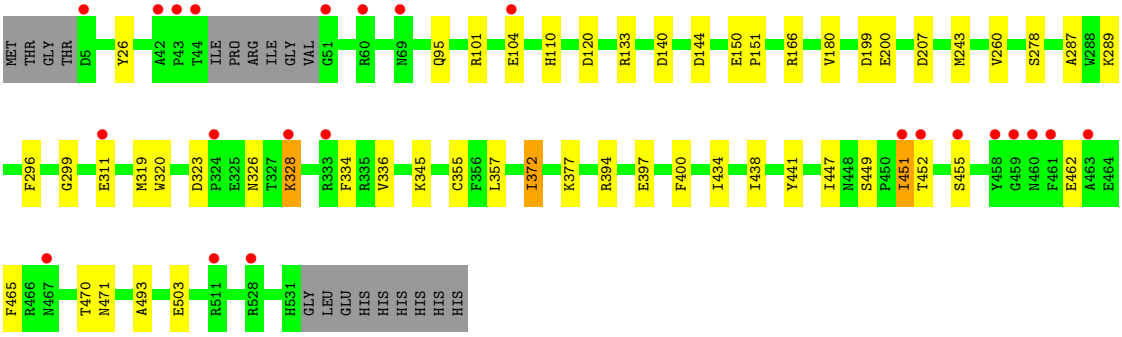
Chain D:





- Molecule 1: Trp-7-FDH





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	57.10Å 106.50Å 110.64Å 102.27° 90.82° 101.35°	Depositor
Resolution (Å)	54.02 – 2.50 54.02 – 2.50	Depositor EDS
% Data completeness (in resolution range)	98.7 (54.02-2.50) 98.7 (54.02-2.50)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.32 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.8.0425	Depositor
R, R_{free}	0.220 , 0.259 0.225 , 0.263	Depositor DCC
R_{free} test set	4154 reflections (4.82%)	wwPDB-VP
Wilson B-factor (Å^2)	39.8	Xtriage
Anisotropy	0.644	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 40.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.51$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	17066	wwPDB-VP
Average B, all atoms (Å^2)	42.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 20.36 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 8.8317e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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	0.65	0/4324	1.12	13/5878 (0.2%)
1	B	0.61	0/4343	1.10	11/5904 (0.2%)
1	C	0.61	0/4335	1.09	9/5893 (0.2%)
1	D	0.60	0/4335	1.08	12/5893 (0.2%)
All	All	0.62	0/17337	1.10	45/23568 (0.2%)

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	A	0	3
1	B	0	3
1	C	0	3
1	D	0	5
All	All	0	14

There are no bond length outliers.

The worst 5 of 45 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	120	ASP	CA-CB-CG	9.90	122.50	112.60
1	B	120	ASP	CA-CB-CG	8.89	121.49	112.60
1	C	334	PHE	CA-CB-CG	6.75	120.55	113.80
1	D	452	THR	CA-CB-OG1	-6.71	99.53	109.60
1	A	144	ASP	CA-CB-CG	6.54	119.14	112.60

There are no chirality outliers.

5 of 14 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	133	ARG	Sidechain
1	B	166	ARG	Sidechain
1	B	60	ARG	Sidechain
1	C	133	ARG	Sidechain
1	C	166	ARG	Sidechain

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	4199	0	3993	23	0
1	B	4218	0	4016	23	0
1	C	4210	0	4012	33	0
1	D	4210	0	4005	37	0
2	A	74	0	0	2	0
2	B	46	0	0	1	0
2	C	68	0	0	8	0
2	D	41	0	0	7	0
All	All	17066	0	16026	107	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 3.

The worst 5 of 107 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:78:ASN:OD1	1:D:293:LEU:HB3	1.54	1.07
1:C:60:ARG:HG2	2:C:667:HOH:O	1.56	1.06
1:C:133:ARG:NH1	2:C:601:HOH:O	2.02	0.92
1:D:369:THR:HG22	1:D:461:PHE:CZ	2.24	0.73
1:D:463:ALA:HB2	1:A:451:ILE:HD12	1.73	0.70

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	517/540 (96%)	503 (97%)	14 (3%)	0	100 100
1	B	520/540 (96%)	506 (97%)	14 (3%)	0	100 100
1	C	519/540 (96%)	503 (97%)	15 (3%)	1 (0%)	43 63
1	D	519/540 (96%)	503 (97%)	16 (3%)	0	100 100
All	All	2075/2160 (96%)	2015 (97%)	59 (3%)	1 (0%)	100 100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	49	GLY

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	438/454 (96%)	426 (97%)	12 (3%)	39 67
1	B	440/454 (97%)	429 (98%)	11 (2%)	42 69
1	C	439/454 (97%)	429 (98%)	10 (2%)	44 72
1	D	439/454 (97%)	429 (98%)	10 (2%)	44 72
All	All	1756/1816 (97%)	1713 (98%)	43 (2%)	43 70

5 of 43 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	461	PHE
1	A	260	VAL
1	D	466	ARG
1	A	110	HIS
1	A	328	LYS

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	D	515	HIS
1	A	326	ASN
1	A	531	HIS
1	A	417	ASN
1	A	135	HIS

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 oligosaccharides 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, 95^{th} 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	521/540 (96%)	0.29	23 (4%)	39	34	21, 34, 60, 99	0
1	B	524/540 (97%)	0.54	34 (6%)	25	22	23, 39, 72, 101	0
1	C	523/540 (96%)	0.61	30 (5%)	29	26	21, 41, 74, 101	0
1	D	523/540 (96%)	0.72	48 (9%)	14	13	26, 43, 76, 118	0
All	All	2091/2160 (96%)	0.54	135 (6%)	25	22	21, 39, 72, 118	0

The worst 5 of 135 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	451	ILE	7.2
1	C	48	ILE	7.0
1	D	463	ALA	6.8
1	B	48	ILE	6.4
1	D	461	PHE	6.0

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 oligosaccharides in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.