



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2026 – 06:06 AM UTC

PDB ID : 1T5F / pdb_00001t5f
Title : arginase I-AOH complex
Authors : Shin, H.; Cama, E.; Christianson, D.W.
Deposited on : 2004-05-04
Resolution : 2.20 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)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

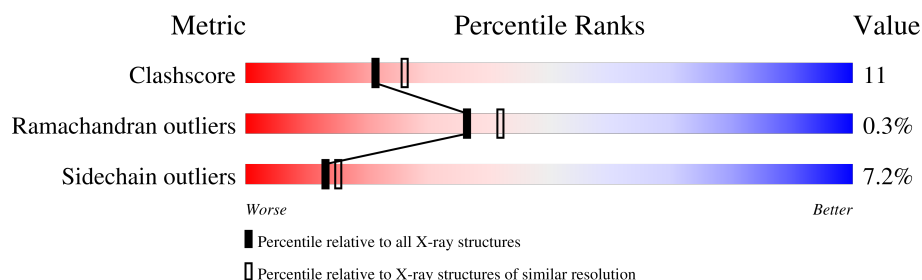
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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))
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)

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 $\leq 5\%$

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	314	 75% 20% 5%
1	B	314	 74% 21% 5%
1	C	314	 73% 22% 5%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 7442 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 Arginase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	314	Total	C	N	O	S	0	0	0
			2385	1523	402	455	5			
1	B	314	Total	C	N	O	S	0	0	0
			2385	1523	402	455	5			
1	C	314	Total	C	N	O	S	0	0	0
			2385	1523	402	455	5			

There are 15 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	19	CYS	GLN	engineered mutation	UNP P07824
A	119	ALA	CYS	engineered mutation	UNP P07824
A	141	ALA	HIS	engineered mutation	UNP P07824
A	168	ALA	CYS	engineered mutation	UNP P07824
A	303	ALA	CYS	engineered mutation	UNP P07824
B	19	CYS	GLN	engineered mutation	UNP P07824
B	119	ALA	CYS	engineered mutation	UNP P07824
B	141	ALA	HIS	engineered mutation	UNP P07824
B	168	ALA	CYS	engineered mutation	UNP P07824
B	303	ALA	CYS	engineered mutation	UNP P07824
C	19	CYS	GLN	engineered mutation	UNP P07824
C	119	ALA	CYS	engineered mutation	UNP P07824
C	141	ALA	HIS	engineered mutation	UNP P07824
C	168	ALA	CYS	engineered mutation	UNP P07824
C	303	ALA	CYS	engineered mutation	UNP P07824

- Molecule 2 is MANGANESE (II) ION (CCD ID: MN) (formula: Mn).

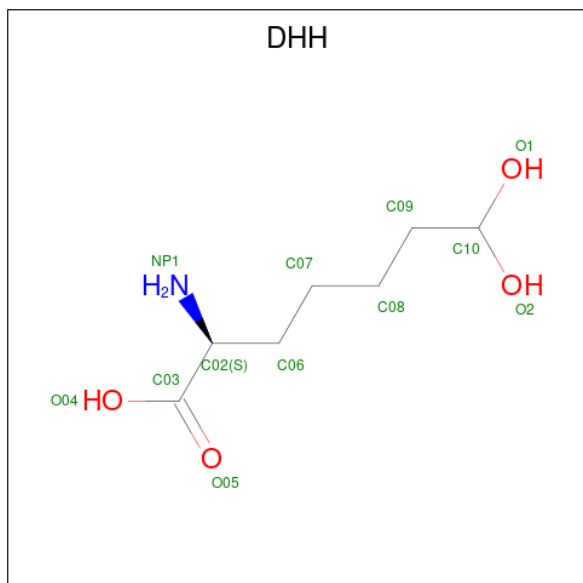
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Mn	0	0
			2	2		

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	2	Total	Mn	0	0
			2	2		
2	C	2	Total	Mn	0	0
			2	2		

- Molecule 3 is (S)-2-AMINO-7,7-DIHYDROXYHEPTANOIC ACID (CCD ID: DHH) (formula: C₇H₁₅NO₄).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			12	7	1	4		
3	B	1	Total	C	N	O	0	0
			12	7	1	4		
3	C	1	Total	C	N	O	0	0
			12	7	1	4		

- Molecule 4 is water.

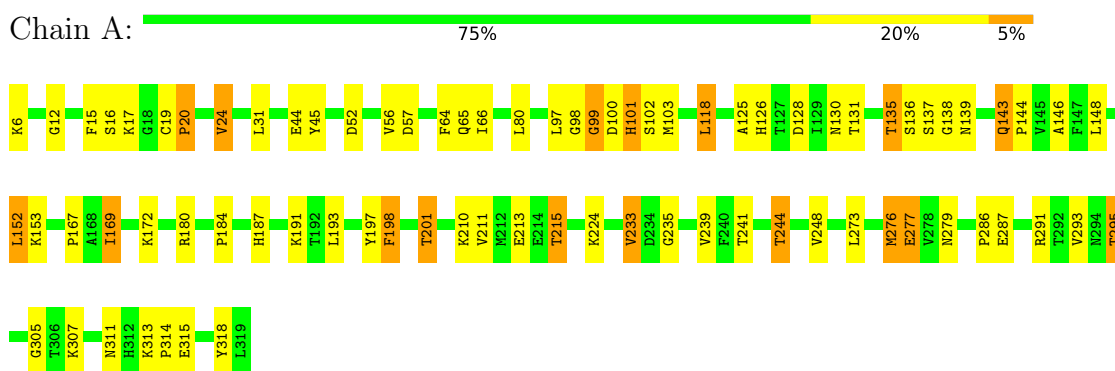
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	71	Total	O	0	0
			71	71		
4	B	94	Total	O	0	0
			94	94		
4	C	80	Total	O	0	0
			80	80		

3 Residue-property plots

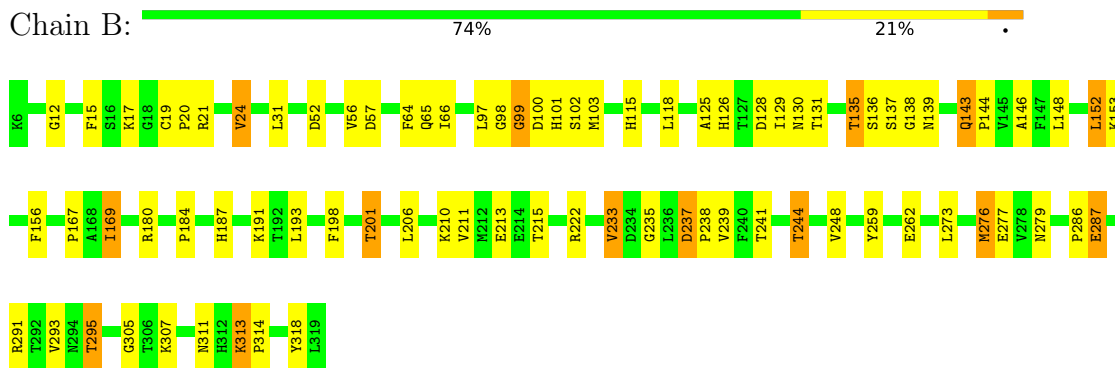
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded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

Note EDS was not executed.

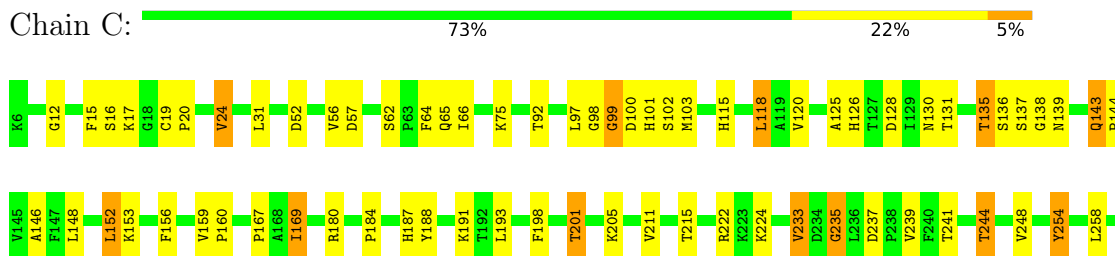
• Molecule 1: Arginase 1



• Molecule 1: Arginase 1



• Molecule 1: Arginase 1



L273	
M276	
E277	
V278	
N279	
E287	
R291	
T292	
V293	
N294	
T295	
G305	
T306	
K307	
N311	
H312	
K313	
P314	
E315	
L319	

4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 32	Depositor
Cell constants a, b, c, α , β , γ	87.90Å 87.90Å 105.20Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	19.59 – 2.20	Depositor
% Data completeness (in resolution range)	90.7 (19.59-2.20)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.222 , 0.241	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	7442	wwPDB-VP
Average B, all atoms (Å ²)	30.0	wwPDB-VP

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: DHH, MN

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	0.88	17/2437 (0.7%)	1.10	15/3310 (0.5%)
1	B	0.73	3/2437 (0.1%)	1.09	14/3310 (0.4%)
1	C	0.80	10/2437 (0.4%)	1.09	16/3310 (0.5%)
All	All	0.81	30/7311 (0.4%)	1.09	45/9930 (0.5%)

The worst 5 of 30 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	156	PHE	CG-CD2	-8.52	1.21	1.38
1	A	198	PHE	CE1-CZ	-8.24	1.14	1.38
1	A	318	TYR	CE2-CZ	-8.24	1.18	1.38
1	C	156	PHE	CE1-CZ	-8.16	1.14	1.38
1	A	45	TYR	CG-CD1	-7.87	1.22	1.39

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	99	GLY	N-CA-C	-11.26	86.49	113.18
1	C	99	GLY	N-CA-C	-11.06	86.96	113.18
1	A	99	GLY	N-CA-C	-11.06	86.97	113.18
1	B	98	GLY	N-CA-C	8.37	126.33	112.85
1	C	98	GLY	N-CA-C	8.14	125.96	112.85

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	2385	0	2415	49	0
1	B	2385	0	2415	60	0
1	C	2385	0	2415	56	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
2	C	2	0	0	0	0
3	A	12	0	13	3	0
3	B	12	0	13	3	0
3	C	12	0	13	3	0
4	A	71	0	0	5	0
4	B	94	0	0	6	0
4	C	80	0	0	5	0
All	All	7442	0	7284	158	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 11.

The worst 5 of 158 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:6:LYS:HB2	4:A:842:HOH:O	1.49	1.11
1:B:135:THR:HB	1:B:137:SER:O	1.81	0.80
1:C:211:VAL:O	1:C:215:THR:HG23	1.80	0.80
1:B:128:ASP:OD1	3:B:1001:DHH:H092	1.83	0.79
1:A:135:THR:HB	1:A:137:SER:O	1.82	0.78

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	312/314 (99%)	303 (97%)	8 (3%)	1 (0%)	36	42
1	B	312/314 (99%)	305 (98%)	6 (2%)	1 (0%)	36	42
1	C	312/314 (99%)	304 (97%)	7 (2%)	1 (0%)	36	42
All	All	936/942 (99%)	912 (97%)	21 (2%)	3 (0%)	36	42

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	143	GLN
1	A	143	GLN
1	B	143	GLN

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	260/260 (100%)	240 (92%)	20 (8%)	12	13
1	B	260/260 (100%)	243 (94%)	17 (6%)	15	18
1	C	260/260 (100%)	241 (93%)	19 (7%)	13	15
All	All	780/780 (100%)	724 (93%)	56 (7%)	13	15

5 of 56 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	222	ARG
1	C	313	LYS
1	B	295	THR
1	C	295	THR
1	C	233	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	311	ASN
1	C	115	HIS
1	B	311	ASN
1	B	115	HIS
1	C	79	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 9 ligands modelled in this entry, 6 are monoatomic - leaving 3 for Mogul analysis.

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	$\# Z > 2$
3	DHH	B	1001	2	10,11,11	1.86	3 (30%)	10,13,13	1.85	1 (10%)
3	DHH	A	1000	2	10,11,11	1.87	3 (30%)	10,13,13	1.85	1 (10%)
3	DHH	C	1002	2	10,11,11	1.86	3 (30%)	10,13,13	1.85	1 (10%)

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
3	DHH	B	1001	2	-	4/11/11/11	-
3	DHH	A	1000	2	-	4/11/11/11	-
3	DHH	C	1002	2	-	4/11/11/11	-

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1000	DHH	O05-C03	3.83	1.33	1.22
3	C	1002	DHH	O05-C03	3.81	1.33	1.22
3	B	1001	DHH	O05-C03	3.80	1.33	1.22
3	A	1000	DHH	C06-C02	2.98	1.59	1.53
3	C	1002	DHH	C06-C02	2.97	1.59	1.53

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	1002	DHH	O2-C10-O1	-4.44	100.85	111.70
3	B	1001	DHH	O2-C10-O1	-4.44	100.85	111.70
3	A	1000	DHH	O2-C10-O1	-4.44	100.85	111.70

There are no chirality outliers.

5 of 12 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1000	DHH	C03-C02-C06-C07
3	B	1001	DHH	C03-C02-C06-C07
3	C	1002	DHH	C03-C02-C06-C07
3	A	1000	DHH	C08-C09-C10-O2
3	B	1001	DHH	C08-C09-C10-O2

There are no ring outliers.

3 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	1001	DHH	3	0
3	A	1000	DHH	3	0
3	C	1002	DHH	3	0

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.