



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 15, 2020 – 08:14 pm BST

PDB ID : 1AHE  
Title : ASPARTATE AMINOTRANSFERASE HEXAMUTANT  
Authors : Malashkevich, V.N.; Jansonius, J.N.  
Deposited on : 1995-02-22  
Resolution : 2.30 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](mailto: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.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.11

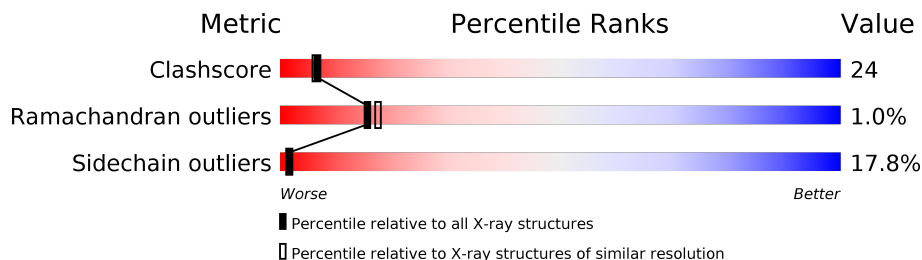
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.30 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	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	396	51%	36%	12%	.
1	B	396	52%	35%	11%	.

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	PLP	B	412	-	X	-	-

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6582 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 ASPARTATE AMINOTRANSFERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	396	3071	1942	533	583	13	0	0	0
1	B	396	3071	1942	533	583	13	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

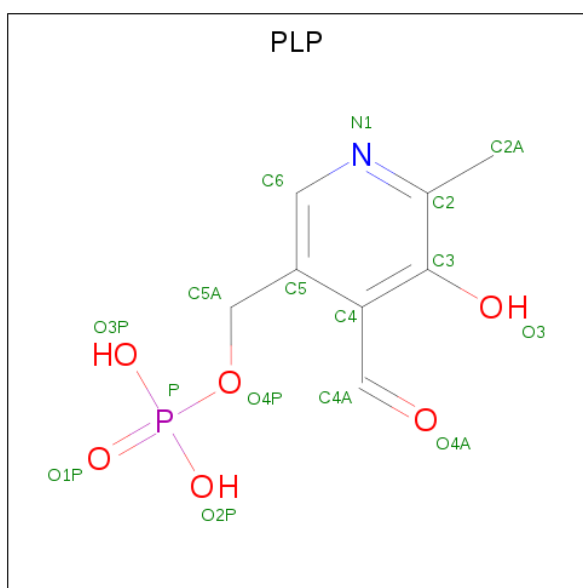
Chain	Residue	Modelled	Actual	Comment	Reference
A	39	LEU	VAL	CONFLICT	UNP P00509
A	41	TYR	LYS	CONFLICT	UNP P00509
A	47	ILE	THR	CONFLICT	UNP P00509
A	69	LEU	ASN	CONFLICT	UNP P00509
A	109	SER	THR	CONFLICT	UNP P00509
A	297	SER	ASN	CONFLICT	UNP P00509
B	39	LEU	VAL	CONFLICT	UNP P00509
B	41	TYR	LYS	CONFLICT	UNP P00509
B	47	ILE	THR	CONFLICT	UNP P00509
B	69	LEU	ASN	CONFLICT	UNP P00509
B	109	SER	THR	CONFLICT	UNP P00509
B	297	SER	ASN	CONFLICT	UNP P00509

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	O	S	0	0	
			5	4	1			
2	B	1	Total	O	S	0	0	
			5	4	1			

- Molecule 3 is PYRIDOXAL-5'-PHOSPHATE (three-letter code: PLP) (formula: C<sub>8</sub>H<sub>10</sub>NO<sub>6</sub>P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			15	8	1	5	1		
3	B	1	Total	C	N	O	P	0	0
			15	8	1	5	1		

- Molecule 4 is water.

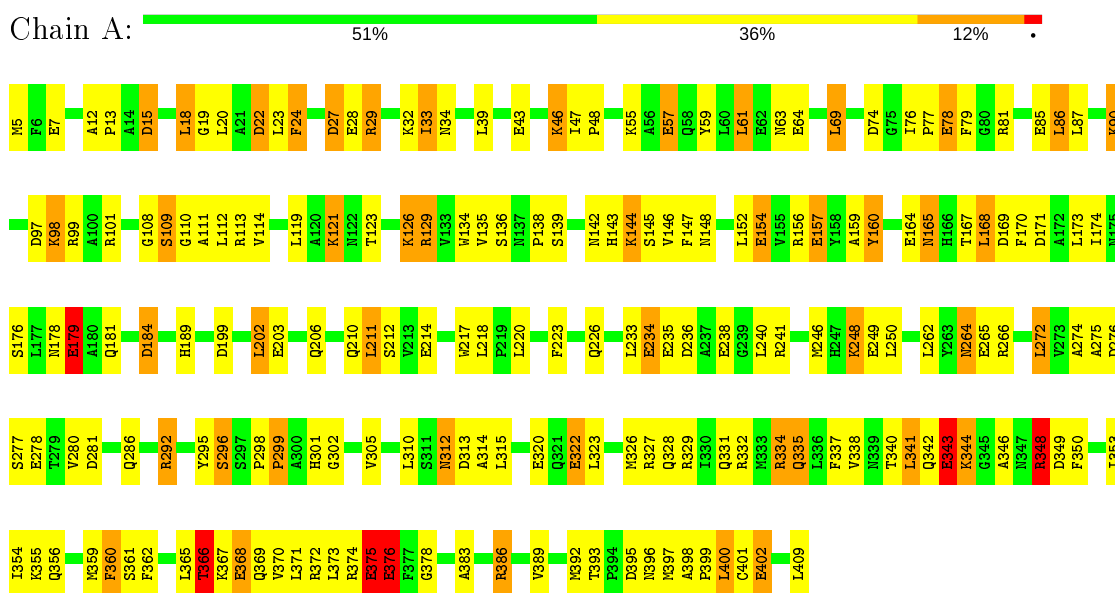
<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
4	A	209	Total 209	O 209	0	0
4	B	191	Total 191	O 191	0	0

### 3 Residue-property plots

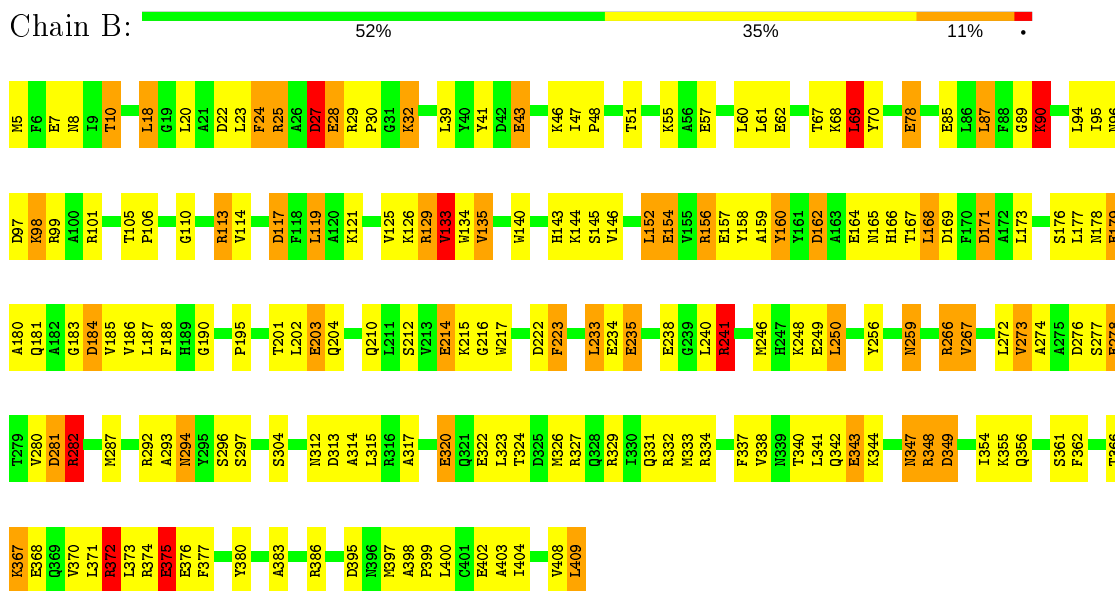
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according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



- Molecule 1: ASPARTATE AMINOTRANSFERASE



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	85.07Å 77.98Å 88.86Å 90.00° 118.63° 90.00°	Depositor
Resolution (Å)	8.00 – 2.30	Depositor
% Data completeness (in resolution range)	96.0 (8.00-2.30)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	TNT	Depositor
R, $R_{free}$	0.203 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	6582	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	42.0	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: SO4, PLP

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	1.02	25/3133 (0.8%)	1.29	35/4244 (0.8%)
1	B	1.01	22/3133 (0.7%)	1.33	39/4244 (0.9%)
All	All	1.02	47/6266 (0.8%)	1.31	74/8488 (0.9%)

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	1	0

The worst 5 of 47 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	123	THR	C-N	-8.61	1.14	1.34
1	A	85	GLU	CD-OE1	6.93	1.33	1.25
1	B	179	GLU	CD-OE1	6.92	1.33	1.25
1	A	203	GLU	CD-OE2	6.86	1.33	1.25
1	B	62	GLU	CD-OE2	6.85	1.33	1.25

The worst 5 of 74 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	267	VAL	CG1-CB-CG2	-10.42	94.22	110.90
1	A	123	THR	O-C-N	-10.15	106.47	122.70
1	B	282	ARG	NE-CZ-NH1	-8.21	116.19	120.30
1	A	171	ASP	CB-CG-OD2	-7.43	111.61	118.30
1	A	27	ASP	CB-CG-OD2	-7.41	111.63	118.30



All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	165	ASN	CA

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	3071	0	3019	156	0
1	B	3071	0	3020	147	0
2	A	5	0	0	1	0
2	B	5	0	0	0	0
3	A	15	0	6	1	0
3	B	15	0	6	0	0
4	A	209	0	0	12	0
4	B	191	0	0	6	0
All	All	6582	0	6051	288	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 24.

The worst 5 of 288 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:144:LYS:HZ3	1:A:148:ASN:HD21	1.11	0.98
1:A:366:THR:HG22	1:A:369:GLN:H	1.31	0.95
1:A:46:LYS:HD2	1:A:47:ILE:H	1.32	0.95
1:A:165:ASN:H	1:A:165:ASN:HD22	1.03	0.93
1:A:165:ASN:N	1:A:165:ASN:HD22	1.54	0.91

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	394/396 (100%)	368 (93%)	22 (6%)	4 (1%)	15	17
1	B	394/396 (100%)	369 (94%)	21 (5%)	4 (1%)	15	17
All	All	788/792 (100%)	737 (94%)	43 (6%)	8 (1%)	15	17

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	346	ALA
1	A	343	GLU
1	B	347	ASN
1	A	20	LEU
1	B	30	PRO

### 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	320/320 (100%)	264 (82%)	56 (18%)	2	2
1	B	320/320 (100%)	262 (82%)	58 (18%)	1	1
All	All	640/640 (100%)	526 (82%)	114 (18%)	2	1

5 of 114 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	371	LEU

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Mol	Chain	Res	Type
1	B	61	LEU
1	B	349	ASP
1	A	376	GLU
1	B	18	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 29 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	328	GLN
1	A	357	ASN
1	B	328	GLN
1	A	335	GLN
1	A	388	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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

4 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
3	PLP	B	412	1	15,15,16	1.77	4 (26%)	20,22,23	1.85	10 (50%)
2	SO4	B	411	-	4,4,4	0.17	0	6,6,6	0.46	0
3	PLP	A	412	1	15,15,16	1.89	2 (13%)	20,22,23	2.56	8 (40%)
2	SO4	A	411	-	4,4,4	0.29	0	6,6,6	0.61	0

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	PLP	B	412	1	-	4/6/6/8	0/1/1/1
3	PLP	A	412	1	-	5/6/6/8	0/1/1/1

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	412	PLP	C5-C4	5.64	1.46	1.40
3	B	412	PLP	C5-C4	4.72	1.45	1.40
3	B	412	PLP	C5A-C5	2.60	1.58	1.50
3	A	412	PLP	P-O3P	-2.59	1.44	1.54
3	B	412	PLP	C4A-C4	-2.54	1.46	1.51

The worst 5 of 18 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	412	PLP	C4A-C4-C5	6.00	127.11	120.94
3	A	412	PLP	C6-C5-C4	4.81	121.95	118.16
3	A	412	PLP	C3-C4-C5	-4.45	113.93	118.74
3	A	412	PLP	C5A-C5-C6	-3.04	114.37	119.37
3	B	412	PLP	C4A-C4-C5	3.00	124.02	120.94

There are no chirality outliers.

5 of 9 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	412	PLP	C4-C5-C5A-O4P
3	B	412	PLP	C6-C5-C5A-O4P
3	B	412	PLP	C5A-O4P-P-O2P
3	A	412	PLP	C4-C5-C5A-O4P
3	A	412	PLP	C6-C5-C5A-O4P

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	412	PLP	1	0
2	A	411	SO4	1	0

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	123:THR	C	124:SER	N	1.14

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.