



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 10:37 PM UTC

PDB ID : 1QIR / pdb\_00001qir  
Title : ASPARTATE AMINOTRANSFERASE FROM ESCHERICHIA COLI,  
C191Y MUTATION, WITH BOUND MALEATE  
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Deposited on : 1999-06-15  
Resolution : 2.20 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

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<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>.

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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

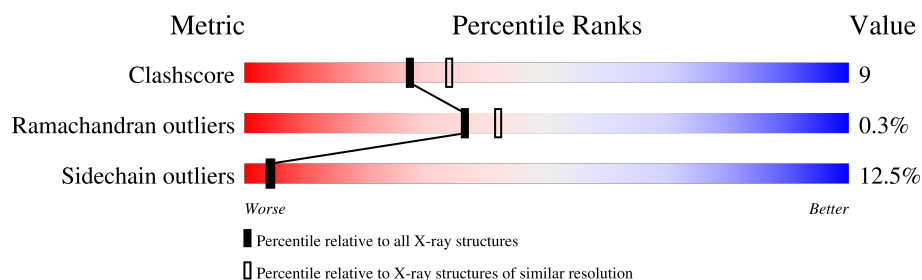
# 1 Overall quality at a glance

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  $\geq 3$ , 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	

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 3872 atoms, of which 695 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	H	N	O	S			
1	A	396	3770	1942	695	536	585	12	0	0	0

There is a discrepancy between the modelled and reference sequences:

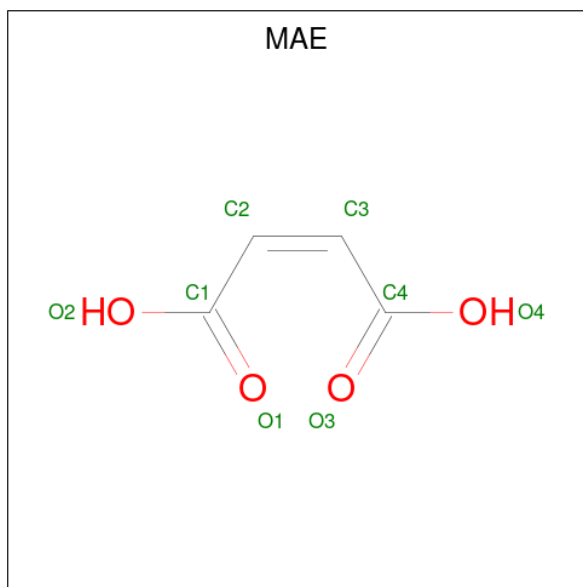
Chain	Residue	Modelled	Actual	Comment	Reference
A	191	TYR	CYS	engineered mutation	UNP P00509

- Molecule 2 is PYRIDOXAL-5'-PHOSPHATE (CCD ID: PLP) (formula:  $C_8H_{10}NO_6P$ ).



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

- Molecule 3 is MALEIC ACID (CCD ID: MAE) (formula:  $C_4H_4O_4$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			8	4	4		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	79	Total	O	0	0
			79	79		

### 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: ASPARTATE AMINOTRANSFERASE



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	157.18 Å   85.40 Å   78.51 Å 90.00°   90.00°   90.00°	Depositor
Resolution (Å)	10.00 – 2.20	Depositor
% Data completeness (in resolution range)	80.0 (10.00-2.20)	Depositor
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	X-PLOR 3.851	Depositor
R, $R_{free}$	0.185 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3872	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	21.0	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: MAE, 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	0.65	1/3137 (0.0%)	1.21	19/4250 (0.4%)

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	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	298	PRO	CA-C	6.59	1.58	1.52

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	63	ASN	N-CA-C	10.41	125.98	113.28
1	A	360	PHE	N-CA-C	8.96	123.49	109.07
1	A	298	PRO	N-CA-C	7.42	119.75	110.70
1	A	196	THR	N-CA-C	7.12	121.20	112.23
1	A	363	SER	N-CA-C	6.88	119.62	111.71
1	A	300	ALA	N-CA-C	6.78	118.75	111.36
1	A	238	GLU	N-CA-C	6.55	118.97	111.11
1	A	18	LEU	N-CA-C	6.39	119.23	111.82
1	A	346	ALA	N-CA-C	-6.35	100.01	109.15
1	A	29	ARG	CB-CG-CD	-5.71	98.17	111.30
1	A	233	LEU	N-CA-C	5.67	117.91	111.11
1	A	49	VAL	N-CA-C	-5.60	100.35	108.87

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	380	TYR	N-CA-C	5.45	117.64	107.99
1	A	157	GLU	N-CA-C	5.31	118.14	109.59
1	A	170	PHE	N-CA-C	5.30	117.05	111.28
1	A	201	THR	N-CA-C	-5.27	103.93	110.41
1	A	242	ALA	N-CA-C	-5.25	105.56	111.28
1	A	313	ASP	N-CA-C	5.23	116.98	111.28
1	A	88	PHE	N-CA-C	5.03	119.69	113.50

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	360	PHE	Mainchain

## 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	3075	695	3020	56	0
2	A	15	0	7	2	0
3	A	8	0	2	0	0
4	A	79	0	0	7	0
All	All	3177	695	3029	56	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 9.

All (56) 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:43:GLU:HG3	4:A:2010:HOH:O	1.81	0.81
1:A:50:LEU:HB2	1:A:53:VAL:HG13	1.68	0.75
1:A:375:GLU:OE1	4:A:2073:HOH:O	2.04	0.75
1:A:346:ALA:HB2	1:A:405:VAL:HG12	1.73	0.70
1:A:49:VAL:HG23	1:A:53:VAL:HG22	1.74	0.69

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:58:GLN:O	1:A:62:GLU:HG2	1.94	0.67
1:A:210:GLN:O	1:A:213:VAL:HG12	1.98	0.64
1:A:312:ASN:HD22	1:A:315:LEU:H	1.47	0.62
1:A:361:SER:HB3	1:A:387:VAL:HG23	1.81	0.61
1:A:126:LYS:HD2	4:A:2033:HOH:O	2.00	0.61
1:A:397:MET:HE3	1:A:397:MET:HA	1.83	0.59
1:A:121:LYS:NZ	1:A:122:ASN:HD21	2.00	0.59
1:A:312:ASN:ND2	1:A:315:LEU:H	2.02	0.58
1:A:361:SER:HB3	1:A:387:VAL:CG2	2.34	0.57
1:A:266:ARG:HH22	2:A:410:PLP:P	2.27	0.57
1:A:396:ASN:HD22	1:A:396:ASN:C	2.16	0.54
1:A:121:LYS:HZ2	1:A:122:ASN:HD21	1.57	0.53
1:A:212:SER:HB3	1:A:217:TRP:HE3	1.74	0.52
1:A:41:LYS:HG2	1:A:45:GLY:HA2	1.91	0.52
1:A:397:MET:HE2	1:A:401:CYS:SG	2.50	0.51
1:A:191:TYR:HB2	4:A:2041:HOH:O	2.10	0.51
1:A:33:ILE:HG22	1:A:35:LEU:HD13	1.92	0.51
1:A:335:GLN:HA	1:A:354:ILE:HD11	1.93	0.50
1:A:194:ASN:HD21	1:A:386:ARG:HH11	1.59	0.49
1:A:170:PHE:O	1:A:174:ILE:HG12	2.12	0.49
1:A:17:ILE:HD11	1:A:141:PRO:HD2	1.94	0.49
1:A:49:VAL:HG22	1:A:54:LYS:HG2	1.95	0.48
1:A:212:SER:HB3	1:A:217:TRP:CE3	2.49	0.48
1:A:53:VAL:O	1:A:57:GLU:HG3	2.14	0.47
1:A:271:THR:HG23	4:A:2053:HOH:O	2.15	0.47
1:A:370:VAL:HG11	1:A:383:ALA:HA	1.97	0.47
1:A:78:GLU:HG3	1:A:81:ARG:NH1	2.30	0.47
1:A:393:THR:H	1:A:396:ASN:ND2	2.13	0.47
1:A:350:PHE:HB3	1:A:353:ILE:HD12	1.96	0.46
1:A:24:PHE:CE1	1:A:32:LYS:HB2	2.50	0.46
1:A:102:THR:HB	1:A:271:THR:HB	1.97	0.45
1:A:21:ALA:O	1:A:25:ARG:HG2	2.17	0.44
1:A:49:VAL:HG23	1:A:53:VAL:CG2	2.45	0.44
1:A:34:ASN:ND2	1:A:36:GLY:H	2.16	0.44
1:A:144:LYS:HA	1:A:155:VAL:HG21	2.00	0.44
1:A:194:ASN:HA	1:A:195:PRO:HA	1.79	0.44
1:A:27:ASP:HB3	1:A:32:LYS:HE2	2.01	0.43
1:A:106:PRO:HD3	1:A:295:TYR:CZ	2.53	0.43
1:A:292:ARG:HA	1:A:296:SER:HA	2.00	0.43
1:A:223:PHE:HE1	4:A:2041:HOH:O	2.01	0.42
1:A:32:LYS:H	1:A:32:LYS:HG3	1.66	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:210:GLN:HE21	1:A:210:GLN:HB3	1.68	0.42
1:A:291:ILE:HG23	1:A:295:TYR:CZ	2.53	0.42
1:A:29:ARG:NH2	1:A:375:GLU:O	2.53	0.42
1:A:41:LYS:HG2	1:A:45:GLY:C	2.45	0.42
1:A:230:ARG:NH1	1:A:235:GLU:HB3	2.35	0.41
1:A:310:LEU:HD12	1:A:310:LEU:HA	1.87	0.41
1:A:37:ILE:HG13	1:A:38:GLY:N	2.35	0.40
1:A:29:ARG:HA	1:A:30:PRO:HD3	1.90	0.40
1:A:222:ASP:OD2	2:A:410:PLP:N1	2.55	0.40
1:A:271:THR:CG2	4:A:2053:HOH:O	2.68	0.40

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%)	380 (96%)	13 (3%)	1 (0%)	36	42

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	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%)	280 (88%)	40 (12%)	<b>4</b> <b>4</b>

All (40) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	32	LYS
1	A	41	LYS
1	A	43	GLU
1	A	46	LYS
1	A	49	VAL
1	A	53	VAL
1	A	60	LEU
1	A	66	THR
1	A	86	LEU
1	A	102	THR
1	A	121	LYS
1	A	126	LYS
1	A	129	ARG
1	A	152	LEU
1	A	173	LEU
1	A	177	LEU
1	A	194	ASN
1	A	195	PRO
1	A	202	LEU
1	A	210	GLN
1	A	223	PHE
1	A	251	ILE
1	A	252	VAL
1	A	265	GLU
1	A	271	THR
1	A	273	VAL
1	A	277	SER
1	A	297	ASN
1	A	310	LEU
1	A	312	ASN
1	A	315	LEU
1	A	336	LEU
1	A	344	LYS
1	A	348	ARG
1	A	365	LEU
1	A	371	LEU
1	A	372	ARG
1	A	374	ARG

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Mol	Chain	Res	Type
1	A	396	ASN
1	A	400	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	34	ASN
1	A	96	ASN
1	A	104	GLN
1	A	122	ASN
1	A	148	ASN
1	A	194	ASN
1	A	210	GLN
1	A	226	GLN
1	A	286	GLN
1	A	312	ASN
1	A	328	GLN
1	A	339	ASN
1	A	357	ASN
1	A	396	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 oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

2 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	PLP	A	410	1	15,15,16	2.48	5 (33%)	21,22,23	2.70	6 (28%)
3	MAE	A	411	-	7,7,7	0.98	0	8,8,8	0.83	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
2	PLP	A	410	1	-	2/6/6/8	0/1/1/1
3	MAE	A	411	-	-	2/5/5/5	-

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	410	PLP	C3-C2	-6.73	1.34	1.41
2	A	410	PLP	P-O3P	-3.68	1.41	1.54
2	A	410	PLP	O4P-C5A	-3.65	1.31	1.44
2	A	410	PLP	C2A-C2	2.56	1.54	1.50
2	A	410	PLP	C6-C5	-2.10	1.33	1.37

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	410	PLP	O4P-C5A-C5	8.58	125.44	109.36
2	A	410	PLP	O2P-P-O4P	-4.49	94.97	106.67
2	A	410	PLP	C5-C6-N1	-3.37	118.35	123.83
2	A	410	PLP	O3P-P-O2P	3.22	119.88	107.80
2	A	410	PLP	C4A-C4-C3	-2.39	116.54	120.52
2	A	410	PLP	C6-N1-C2	2.32	123.41	119.20

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	410	PLP	C4-C5-C5A-O4P
2	A	410	PLP	C6-C5-C5A-O4P
3	A	411	MAE	O1-C1-C2-C3
3	A	411	MAE	O2-C1-C2-C3

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	410	PLP	2	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

### 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.