wwPDB X-ray Structure Validation Summary Report (i)

Jun 15, 2024 – 10:44 AM EDT

PDB ID	:	2CST
Title	:	CRYSTAL STRUCTURE OF THE CLOSED FORM OF CHICKEN CYTOSOLIC ASPARTATE AMINOTRANSFERASE AT 1.9 ANGSTROMS RESOLUTION
Authors	:	Malashkevich, V.N.; Strokopytov, B.V.; Borisov, V.V.
Deposited on	:	1994-09-06
Resolution	:	1.90 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:

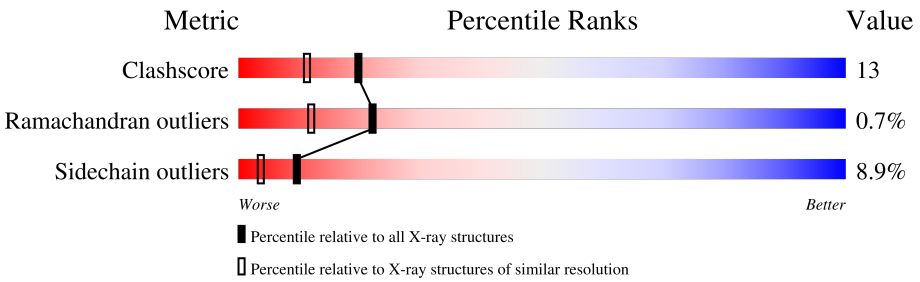
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 1.90 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	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)

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%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	411	76% 19% •
1	B	411	67% 23% 8% •

2 Entry composition (i)

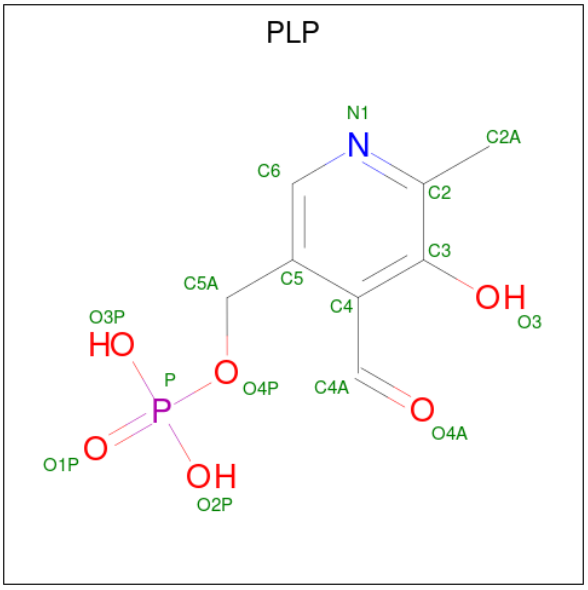
There are 4 unique types of molecules in this entry. The entry contains 7274 atoms, of which 0 are hydrogens and 0 are deuteriums.

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.

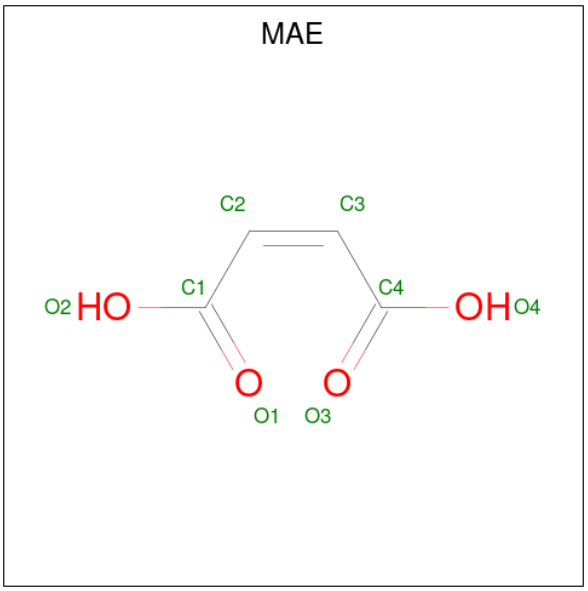
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	411	3230	2049	568	599	14	0	0	0
1	B	411	3230	2049	568	599	14	0	0	0

- Molecule 2 is PYRIDOXAL-5'-PHOSPHATE (three-letter code: 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
2	B	1	15	8	1	5	1	0	0

- Molecule 3 is MALEIC ACID (three-letter code: MAE) (formula: $C_4H_4O_4$).



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

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	406	406	406	0	0
			Total	O		
4	B	362	362	362	0	0

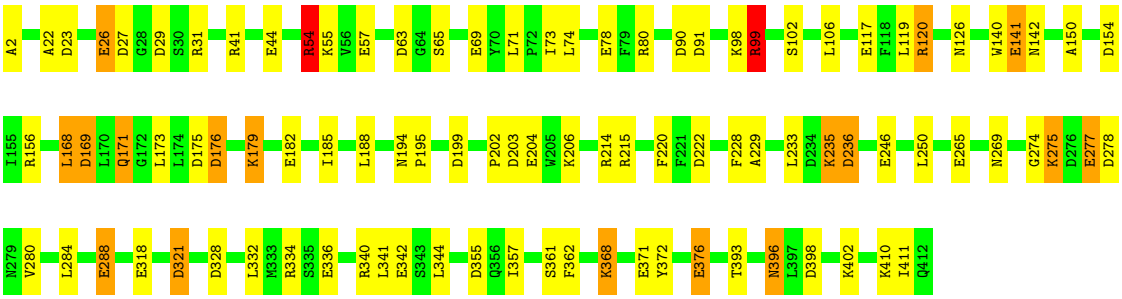
3 Residue-property plots (i)

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. 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.

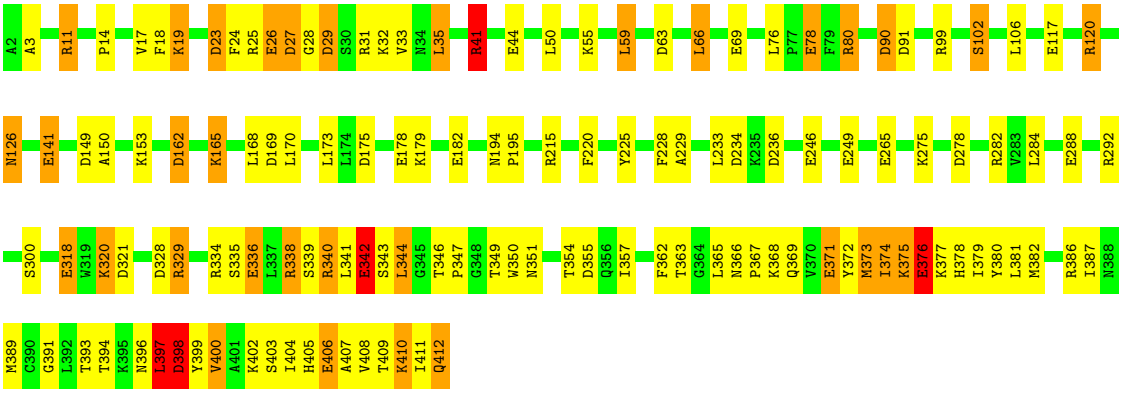
• Molecule 1: ASPARTATE AMINOTRANSFERASE

Chain A:



• Molecule 1: ASPARTATE AMINOTRANSFERASE

Chain B:



4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	56.40Å 126.00Å 124.30Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	6.00 – 1.90	Depositor
% Data completeness (in resolution range)	(Not available) (6.00-1.90)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	TNT	Depositor
R, R_{free}	0.175 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	7274	wwPDB-VP
Average B, all atoms (Å^2)	20.0	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	0.83	17/3307 (0.5%)	1.15	43/4482 (1.0%)
1	B	0.83	18/3307 (0.5%)	1.20	43/4482 (1.0%)
All	All	0.83	35/6614 (0.5%)	1.18	86/8964 (1.0%)

The worst 5 of 35 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	141	GLU	CD-OE1	7.71	1.34	1.25
1	A	44	GLU	CD-OE1	6.80	1.33	1.25
1	B	78	GLU	CD-OE2	6.71	1.33	1.25
1	B	26	GLU	CD-OE1	6.54	1.32	1.25
1	A	265	GLU	CD-OE1	-6.36	1.18	1.25

The worst 5 of 86 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	80	ARG	NE-CZ-NH1	12.13	126.36	120.30
1	B	80	ARG	NE-CZ-NH2	-10.45	115.08	120.30
1	B	99	ARG	NE-CZ-NH2	-9.59	115.50	120.30
1	B	99	ARG	NE-CZ-NH1	9.42	125.01	120.30
1	A	99	ARG	NE-CZ-NH1	9.15	124.87	120.30

There are no chirality outliers.

There are no planarity outliers.

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	3230	0	3177	46	0
1	B	3230	0	3177	121	0
2	A	15	0	6	0	0
2	B	15	0	6	0	0
3	A	8	0	2	0	0
3	B	8	0	2	0	0
4	A	406	0	0	6	0
4	B	362	0	0	12	0
All	All	7274	0	6370	164	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 13.

The worst 5 of 164 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:B:233:LEU:HD12	1:B:320:LYS:HE3	1.40	1.02
1:A:54:ARG:HH11	1:A:54:ARG:HG2	1.29	0.97
1:B:407:ALA:HA	1:B:411:ILE:HG22	1.55	0.88
1:B:387:ILE:HD12	1:B:389:MET:HE1	1.55	0.87
1:B:233:LEU:CD1	1:B:320:LYS:HE3	2.08	0.84

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	409/411 (100%)	400 (98%)	9 (2%)	0	100 100
1	B	409/411 (100%)	378 (92%)	25 (6%)	6 (2%)	10 3

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	818/822 (100%)	778 (95%)	34 (4%)	6 (1%)	22 12

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	397	LEU
1	B	410	LYS
1	B	363	THR
1	B	378	HIS
1	B	342	GLU

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	342/342 (100%)	317 (93%)	25 (7%)	14 6
1	B	342/342 (100%)	306 (90%)	36 (10%)	7 2
All	All	684/684 (100%)	623 (91%)	61 (9%)	9 4

5 of 61 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	41	ARG
1	B	375	LYS
1	B	141	GLU
1	B	374	ILE
1	B	400	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	126	ASN
1	B	281	GLN
1	B	412	GLN

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Mol	Chain	Res	Type
1	A	322	ASN
1	A	269	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 monosaccharides 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	$\#\|Z\| > 2$
2	PLP	A	413	1	15,15,16	1.28	1 (6%)	21,22,23	1.88	6 (28%)
3	MAE	B	414	-	7,7,7	1.37	1 (14%)	8,8,8	0.36	0
3	MAE	A	414	-	7,7,7	1.47	1 (14%)	8,8,8	0.34	0
2	PLP	B	413	1	15,15,16	1.39	2 (13%)	21,22,23	2.06	9 (42%)

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	413	1	-	1/6/6/8	0/1/1/1
3	MAE	B	414	-	-	2/5/5/5	-
3	MAE	A	414	-	-	2/5/5/5	-
2	PLP	B	413	1	-	5/6/6/8	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	413	PLP	C4A-C4	-3.73	1.44	1.51
2	B	413	PLP	C4A-C4	-2.92	1.45	1.51
3	A	414	MAE	O3-C4	2.48	1.29	1.23
2	B	413	PLP	C5A-C5	2.28	1.56	1.50
3	B	414	MAE	O3-C4	2.23	1.28	1.23

The worst 5 of 15 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	413	PLP	C6-C5-C4	4.53	121.81	118.10
2	B	413	PLP	C6-C5-C4	3.76	121.18	118.10
2	B	413	PLP	C2A-C2-C3	3.44	124.82	120.80
2	B	413	PLP	C3-C2-N1	-3.43	116.64	120.96
2	B	413	PLP	C6-N1-C2	3.23	125.05	119.20

There are no chirality outliers.

5 of 10 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	413	PLP	C5A-O4P-P-O2P
2	B	413	PLP	C4-C5-C5A-O4P
2	B	413	PLP	C6-C5-C5A-O4P
2	B	413	PLP	C5A-O4P-P-O1P
2	B	413	PLP	C5A-O4P-P-O2P

There are no ring outliers.

No monomer is involved in short contacts.

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)

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.