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P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

Aug 22, 2023 – 08:45 PM EDT

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PDB ID	:	3CSU
Title	:	CATALYTIC TRIMER OF ESCHERICHIA COLI ASPARTATE TRANSCARBAMOYLASE
Authors	:	Beernink, P.T.; Endrizzi, J.A.; Alber, T.; Schachman, H.K.
Deposited on	:	1999-04-22
Resolution	:	1.88 Å(reported)

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 1.88 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.
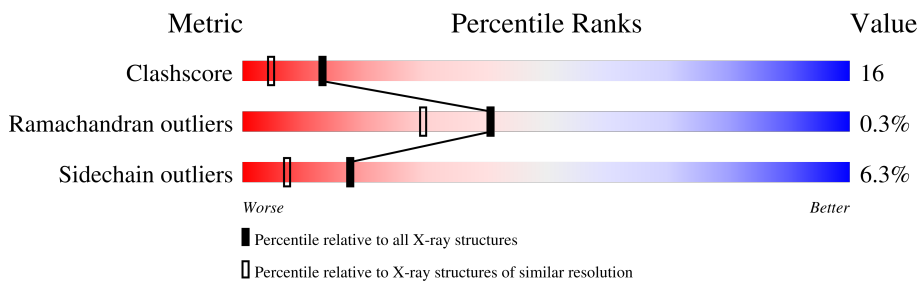
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	10282 (1.90-1.86)
Ramachandran outliers	138981	10152 (1.90-1.86)
Sidechain outliers	138945	10152 (1.90-1.86)

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	310	57% / 30% / 5% · 7%
1	B	310	61% / 26% / 5% · 7%
1	C	310	63% / 29% / 6% ··

2 Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 7601 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 PROTEIN (ASPARTATE CARBAMOYLTRANSFERASE).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	288	Total	C	N	O	S	0	0	0
			2225	1413	385	418	9			
1	B	288	Total	C	N	O	S	0	1	0
			2219	1409	384	417	9			
1	C	304	Total	C	N	O	S	0	0	0
			2366	1494	415	448	9			

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Ca	0	0
			1	1		
2	C	1	Total	Ca	0	0
			1	1		

- Molecule 3 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	234	Total	O	0	0
			234	234		
3	B	233	Total	O	0	0
			233	233		
3	C	322	Total	O	0	0
			322	322		

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.
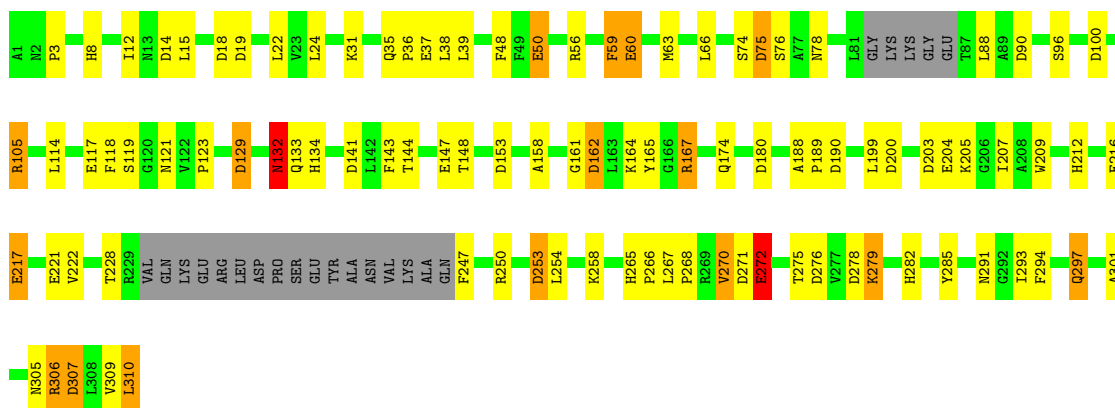
Note EDS was not executed.

• Molecule 1: PROTEIN (ASPARTATE CARBAMOYLTRANSFERASE)

Chain A:
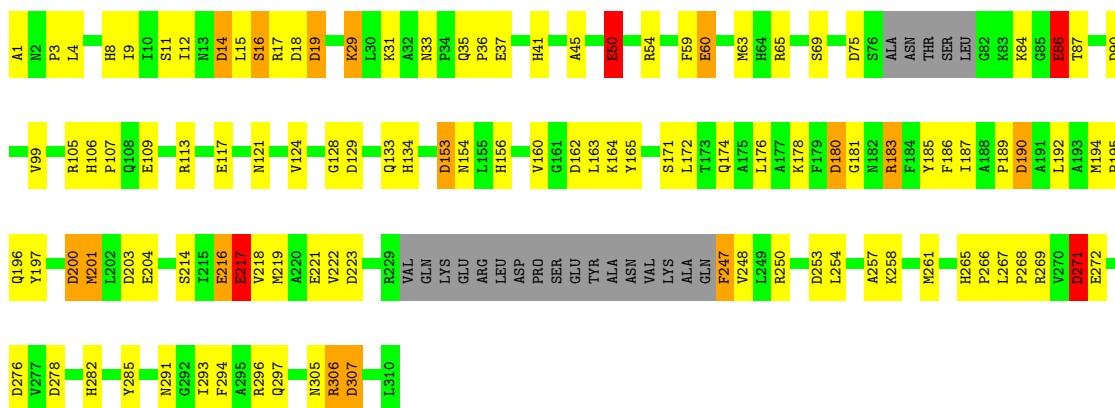
• Molecule 1: PROTEIN (ASPARTATE CARBAMOYLTRANSFERASE)

Chain B:

• Molecule 1: PROTEIN (ASPARTATE CARBAMOYLTRANSFERASE)

Chain C:

A1 H8 I12 N13 D14 L15 S16 R17 D18 D19 L20 L24 A25 K29 E37 C47 E50 A51 S52 T53 R54 T55 R56 L57 S58 F59 E60 T61 S62 M63 H64 R65 F73 S74 D75 N78 T79 S80 L81 GLY LYS LYS GLY E86 D90 Y98 V99 D100

R105 H106 P107 Q108 E109 G110 A111 A112 R113 L114 A115 T116 E117 F118 N121 V122 P123 V124 L125 D129 G130 S131 N132 Q133 D141 L142 Q146 E147 L152 D153 N154 L155 D162 L163 K164 Y165 G166 R167 S171 Q174 A175 D180 G181 N182 R183 D190 A191 L192 P195

D200 M201 L202 D203 E204 K205 G206 E216 E217 E221 V222 D223 M227 Q231 K232 E233 R234 L235 D236 P237 S238 E239 V243 N256 M261 H265 P266 R269 V270 D271 E272 T275 D276 V277 D278 K279 H282 Y285 R296 L299 R306 D307 L308 VAL

LEU

4 Data and refinement statistics ⓘ

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	56.12Å 82.54Å 210.52Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.88	Depositor
% Data completeness (in resolution range)	94.6 (20.00-1.88)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	TNT 5E	Depositor
R, R_{free}	0.190 , 0.291	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	7601	wwPDB-VP
Average B, all atoms (Å^2)	29.0	wwPDB-VP

5   Model quality ⓘ

5.1   Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CA

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	0.77	10/2267 (0.4%)	1.22	33/3078 (1.1%)
1	B	0.76	9/2266 (0.4%)	1.22	34/3081 (1.1%)
1	C	0.79	13/2410 (0.5%)	1.25	39/3272 (1.2%)
All	All	0.77	32/6943 (0.5%)	1.23	106/9431 (1.1%)

The worst 5 of 32 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	60	GLU	CD-OE2	8.20	1.34	1.25
1	B	50	GLU	CD-OE2	7.18	1.33	1.25
1	B	117	GLU	CD-OE2	6.36	1.32	1.25
1	C	147	GLU	CD-OE2	6.25	1.32	1.25
1	C	216	GLU	CD-OE2	6.18	1.32	1.25

The worst 5 of 106 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	162	ASP	CB-CG-OD2	-9.57	109.69	118.30
1	B	90	ASP	CB-CG-OD2	-8.32	110.81	118.30
1	A	19	ASP	CB-CG-OD2	-7.90	111.19	118.30
1	B	162	ASP	CB-CG-OD1	7.82	125.34	118.30
1	A	19	ASP	CB-CG-OD1	7.69	125.22	118.30

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	2225	0	2213	89	0
1	B	2219	0	2207	64	0
1	C	2366	0	2362	70	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
3	A	234	0	0	16	0
3	B	233	0	0	7	0
3	C	322	0	0	11	0
All	All	7601	0	6782	222	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 16.

The worst 5 of 222 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:C:8:HIS:HD2	1:C:124:VAL:H	1.11	0.95
1:C:47:CYS:HB3	1:C:73:PHE:CZ	2.05	0.92
1:B:114:LEU:HD11	1:B:118:PHE:HE2	1.32	0.91
1:C:114:LEU:HD11	1:C:118:PHE:HE2	1.42	0.84
1:A:8:HIS:HD2	1:A:124:VAL:H	1.22	0.83

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	282/310 (91%)	268 (95%)	14 (5%)	0	100	100
1	B	283/310 (91%)	269 (95%)	12 (4%)	2 (1%)	22	11
1	C	300/310 (97%)	290 (97%)	9 (3%)	1 (0%)	41	30
All	All	865/930 (93%)	827 (96%)	35 (4%)	3 (0%)	41	30

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	132	ASN
1	B	270	VAL
1	C	270	VAL

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	238/261 (91%)	219 (92%)	19 (8%)	12	4
1	B	239/261 (92%)	227 (95%)	12 (5%)	24	13
1	C	256/261 (98%)	241 (94%)	15 (6%)	19	9
All	All	733/783 (94%)	687 (94%)	46 (6%)	18	7

5 of 46 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	297	GLN
1	C	121	ASN
1	B	306	ARG
1	C	78	ASN
1	C	167	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 20 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	174	GLN
1	C	255	HIS
1	C	282	HIS
1	C	256	ASN
1	B	291	ASN

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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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 ⓘ

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.