



# wwPDB X-ray Structure Validation Summary Report i

Feb 27, 2014 – 01:59 PM GMT

PDB ID : 1O0C  
Title : CRYSTAL STRUCTURE OF L-GLUTAMATE AND AMPCPP BOUND TO  
GLUTAMINE AMINOACYL TRNA SYNTHETASE  
Authors : Bullock, T.L.; Perona, J.J.  
Deposited on : 2003-02-20  
Resolution : 2.70 Å(reported)

This is a wwPDB 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 <http://wwpdb.org/ValidationPDFNotes.html>

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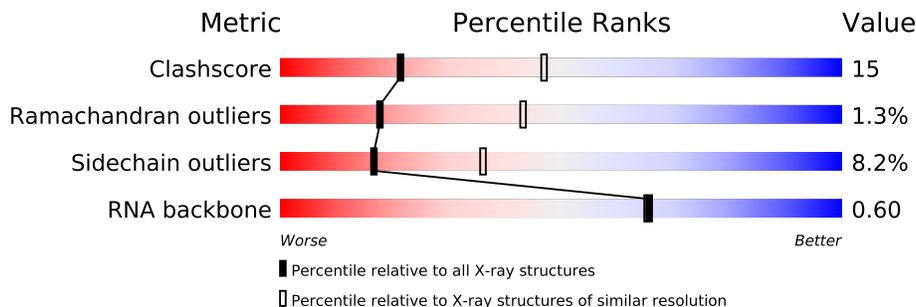
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 21963  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance

The reported resolution of this entry is 2.70 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	79885	1939 (2.70-2.70)
Ramachandran outliers	78287	1905 (2.70-2.70)
Sidechain outliers	78261	1905 (2.70-2.70)
RNA backbone	1838	1042 (3.20-2.20)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	B	75	
2	A	554	

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6036 atoms, of which 0 are hydrogen and 0 are deuterium.

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 RNA chain called Glutaminyl tRNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	B	74	1570	702	279	516	73	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	901	U	G	ENGINEERED	EMBL 43058

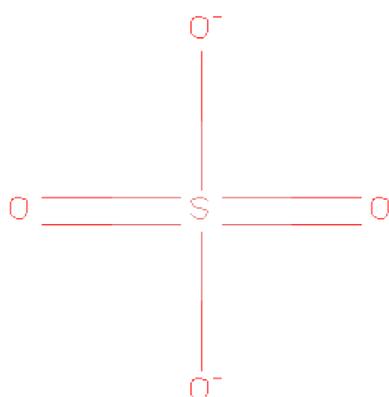
- Molecule 2 is a protein called Glutaminyl-tRNA synthetase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	A	529	4279	2704	752	802	21	0	0	0

There is a discrepancy between the modelled and reference sequences:

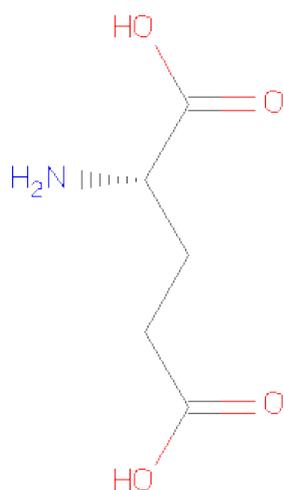
Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	CLONING ARTIFACT	UNP P00962

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



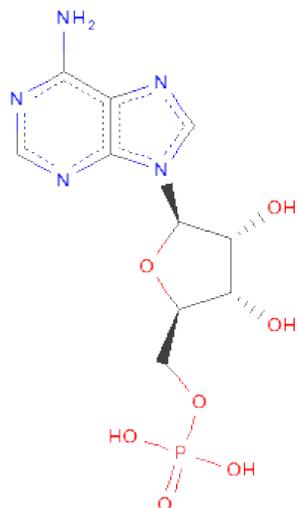
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		
3	A	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is GLUTAMIC ACID (three-letter code: GLU) (formula:  $C_5H_9NO_4$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			10	5	1	4		

- Molecule 5 is ADENOSINE MONOPHOSPHATE (three-letter code: AMP) (formula:  $C_{10}H_{14}N_5O_7P$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
5	A	1	23	10	5	7	1	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	118	Total	O	0	0
			118	118		
6	B	26	Total	O	0	0
			26	26		

### 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 errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). 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.

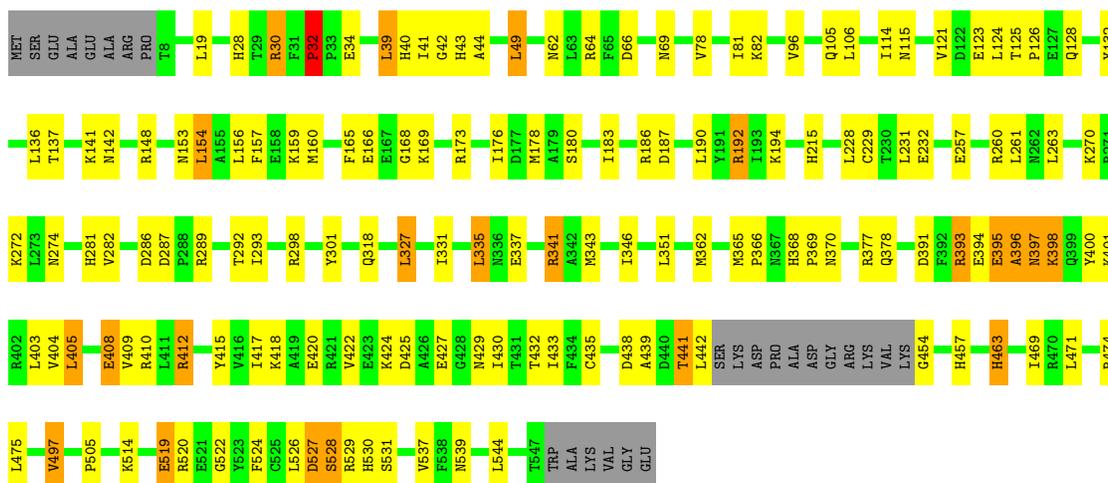
- Molecule 1: Glutamyl tRNA

Chain B: 



- Molecule 2: Glutamyl-tRNA synthetase

Chain A: 



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section will therefore be incomplete.

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	241.10Å 94.58Å 116.08Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	6.00 – 2.70	Depositor
% Data completeness (in resolution range)	5.0 (6.00-2.70)	Depositor
$R_{merge}$	0.07	Depositor
$R_{sym}$	0.06	Depositor
Refinement program	X-PLOR 98.0	Depositor
R, $R_{free}$	0.213 , 0.265	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	6036	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	44.0	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: AMP, SO4

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	B	0.46	0/1753	0.88	8/2730 (0.3%)
2	A	0.44	0/4379	0.68	0/5928
All	All	0.44	0/6132	0.75	8/8658 (0.1%)

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	B	0	4

There are no bond length outliers.

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	919	G	N9-C1'-C2'	6.70	122.71	114.00
1	B	918	G	N9-C1'-C2'	6.46	122.39	114.00
1	B	936	G	N9-C1'-C2'	6.29	122.18	114.00
1	B	974	C	N1-C1'-C2'	5.95	121.74	114.00
1	B	945	A	N9-C1'-C2'	5.86	121.62	114.00

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	919	G	Sidechain
1	B	935	U	Sidechain
1	B	948	C	Sidechain

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Mol	Chain	Res	Type	Group
1	B	960	U	Sidechain

## 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	1570	0	801	60	0
2	A	4279	0	4172	112	0
3	A	10	0	0	2	0
4	A	10	0	5	4	0
5	A	23	0	10	2	0
6	A	118	0	0	6	0
6	B	26	0	0	0	0
All	All	6036	0	4988	163	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 15.

The worst 5 of 163 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:946:U:H4'	1:B:947:U:C6	1.86	1.09
1:B:946:U:H4'	1:B:947:U:C5	1.95	1.01
2:A:531:SER:HB3	2:A:537:VAL:H	1.44	0.83
2:A:39:LEU:HD13	2:A:81:ILE:HG12	1.61	0.81
2:A:522:GLY:HA2	2:A:544:LEU:HD13	1.65	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	
2	A	525/554 (95%)	500 (95%)	18 (3%)	7 (1%)	18	43

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	A	397	ASN
2	A	405	LEU
2	A	32	PRO
2	A	396	ALA
2	A	527	ASP

### 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	
2	A	463/482 (96%)	426 (92%)	37 (8%)	17	37

5 of 37 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	A	231	LEU
2	A	335	LEU
2	A	514	LYS
2	A	232	GLU
2	A	263	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
2	A	226	HIS
2	A	236	ASN
2	A	378	GLN
2	A	153	ASN
2	A	368	HIS

### 5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	B	73/75 (97%)	21 (28%)	13 (17%)

5 of 21 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	B	907	A
1	B	908	U
1	B	909	C
1	B	910	G
1	B	916	C

5 of 13 RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	B	934	C
1	B	935	U
1	B	960	U
1	B	919	G
1	B	948	C

## 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 carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

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	SO4	A	1394	-	4,4,4	1.61	1 (25%)	6,6,6	0.47	0
3	SO4	A	1395	-	4,4,4	1.75	1 (25%)	6,6,6	0.48	0
4	GLU	A	996	-	9,9,9	0.90	0	11,11,11	0.74	0
5	AMP	A	998	-	25,25,25	1.83	4 (16%)	38,38,38	2.90	8 (21%)

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	SO4	A	1394	-	-	0/0/0/0	0/0/0/0
3	SO4	A	1395	-	-	0/0/0/0	0/0/0/0
4	GLU	A	996	-	-	0/9/9/9	0/0/0/0
5	AMP	A	998	-	1/1/5/5	0/10/26/26	0/1/3/3

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	998	AMP	O2'-C2'	-6.98	1.26	1.43
3	A	1395	SO4	O3-S	2.64	1.56	1.47
3	A	1394	SO4	O3-S	2.34	1.55	1.47
5	A	998	AMP	P-O5'	-2.30	1.52	1.60
5	A	998	AMP	P-O2P	-2.20	1.46	1.54

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	998	AMP	O4'-C1'-N9	14.48	121.91	108.44
5	A	998	AMP	C2'-C1'-N9	4.59	125.04	113.27
5	A	998	AMP	O4'-C1'-C2'	4.09	113.04	106.77
5	A	998	AMP	C4'-O4'-C1'	-3.81	105.61	109.75
5	A	998	AMP	O3P-P-O1P	2.79	119.55	110.44

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
5	A	998	AMP	C1'

There are no torsion outliers.

There are no ring outliers.

## 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 will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

### 6.3 Carbohydrates

EDS was not executed - this section will therefore be empty.

### 6.4 Ligands

EDS was not executed - this section will therefore be empty.

### 6.5 Other polymers

EDS was not executed - this section will therefore be empty.