



# wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 21, 2024 – 02:27 AM EDT

PDB ID : 1R6U  
Title : Crystal structure of an active fragment of human tryptophanyl-tRNA synthetase with cytokine activity  
Authors : Yang, X.-L.; Otero, F.J.; Skene, R.J.; McRee, D.E.; Ribas de Pouplana, L.; Schimmel, P.  
Deposited on : 2003-10-16  
Resolution : 2.00 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)

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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 : 4.02b-467  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 1.20.1  
EDS : 3.0  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

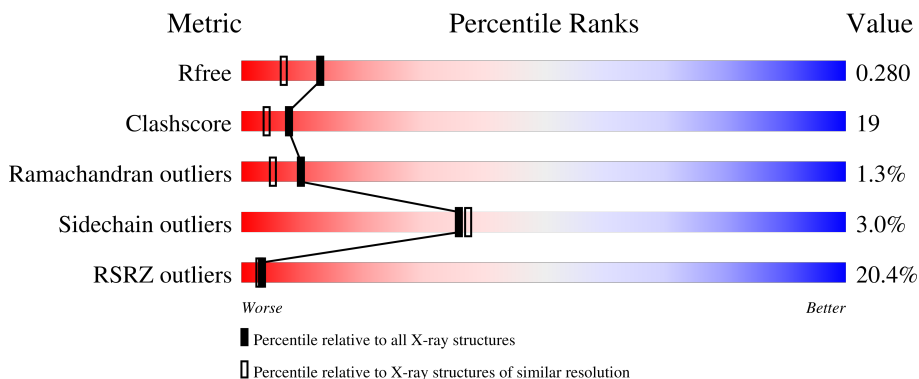
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.00 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))
$R_{free}$	164625	9409 (2.00-2.00)
Clashscore	180529	10737 (2.00-2.00)
Ramachandran outliers	177936	10628 (2.00-2.00)
Sidechain outliers	177891	10627 (2.00-2.00)
RSRZ outliers	164620	9409 (2.00-2.00)

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  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	437	
1	B	437	

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	GOL	A	601	-	X	-	-

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 6205 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 Tryptophanyl-tRNA synthetase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	388	3129	2004	528	582	5	10	0	0	0
1	B	362	2927	1879	497	537	5	9	0	0	0

There are 50 discrepancies between the modelled and reference sequences:

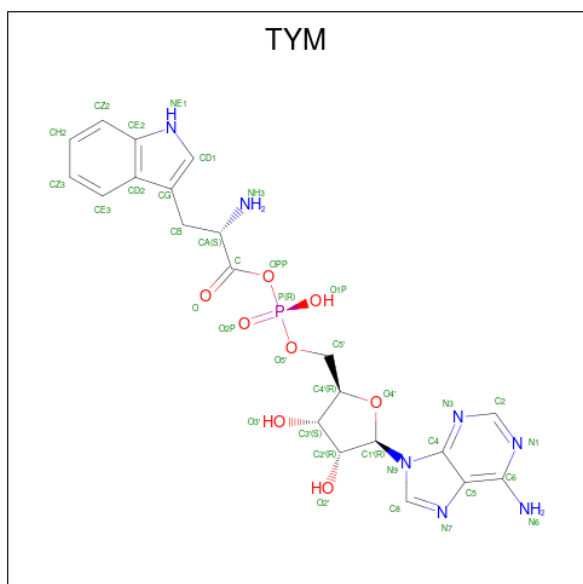
Chain	Residue	Modelled	Actual	Comment	Reference
A	143	MSE	MET	modified residue	UNP P23381
A	169	MSE	MET	modified residue	UNP P23381
A	195	MSE	MET	modified residue	UNP P23381
A	213	GLY	SER	engineered mutation	UNP P23381
A	214	ASP	TYR	engineered mutation	UNP P23381
A	241	MSE	MET	modified residue	UNP P23381
A	243	MSE	MET	modified residue	UNP P23381
A	319	MSE	MET	modified residue	UNP P23381
A	350	MSE	MET	modified residue	UNP P23381
A	401	MSE	MET	modified residue	UNP P23381
A	425	MSE	MET	modified residue	UNP P23381
A	461	MSE	MET	modified residue	UNP P23381
A	472	LYS	-	cloning artifact	UNP P23381
A	473	LEU	-	cloning artifact	UNP P23381
A	474	ALA	-	cloning artifact	UNP P23381
A	475	ALA	-	cloning artifact	UNP P23381
A	476	ALA	-	cloning artifact	UNP P23381
A	477	LEU	-	cloning artifact	UNP P23381
A	478	GLU	-	cloning artifact	UNP P23381
A	479	HIS	-	expression tag	UNP P23381
A	480	HIS	-	expression tag	UNP P23381
A	481	HIS	-	expression tag	UNP P23381
A	482	HIS	-	expression tag	UNP P23381
A	483	HIS	-	expression tag	UNP P23381
A	484	HIS	-	expression tag	UNP P23381

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Chain	Residue	Modelled	Actual	Comment	Reference
B	143	MSE	MET	modified residue	UNP P23381
B	169	MSE	MET	modified residue	UNP P23381
B	195	MSE	MET	modified residue	UNP P23381
B	213	GLY	SER	engineered mutation	UNP P23381
B	214	ASP	TYR	engineered mutation	UNP P23381
B	241	MSE	MET	modified residue	UNP P23381
B	243	MSE	MET	modified residue	UNP P23381
B	319	MSE	MET	modified residue	UNP P23381
B	350	MSE	MET	modified residue	UNP P23381
B	401	MSE	MET	modified residue	UNP P23381
B	425	MSE	MET	modified residue	UNP P23381
B	461	MSE	MET	modified residue	UNP P23381
B	472	LYS	-	cloning artifact	UNP P23381
B	473	LEU	-	cloning artifact	UNP P23381
B	474	ALA	-	cloning artifact	UNP P23381
B	475	ALA	-	cloning artifact	UNP P23381
B	476	ALA	-	cloning artifact	UNP P23381
B	477	LEU	-	cloning artifact	UNP P23381
B	478	GLU	-	cloning artifact	UNP P23381
B	479	HIS	-	expression tag	UNP P23381
B	480	HIS	-	expression tag	UNP P23381
B	481	HIS	-	expression tag	UNP P23381
B	482	HIS	-	expression tag	UNP P23381
B	483	HIS	-	expression tag	UNP P23381
B	484	HIS	-	expression tag	UNP P23381

- Molecule 2 is TRYPTOPHANYL-5'AMP (three-letter code: TYM) (formula: C<sub>21</sub>H<sub>24</sub>N<sub>7</sub>O<sub>8</sub>P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	37	21	7	8	1	0	0

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).

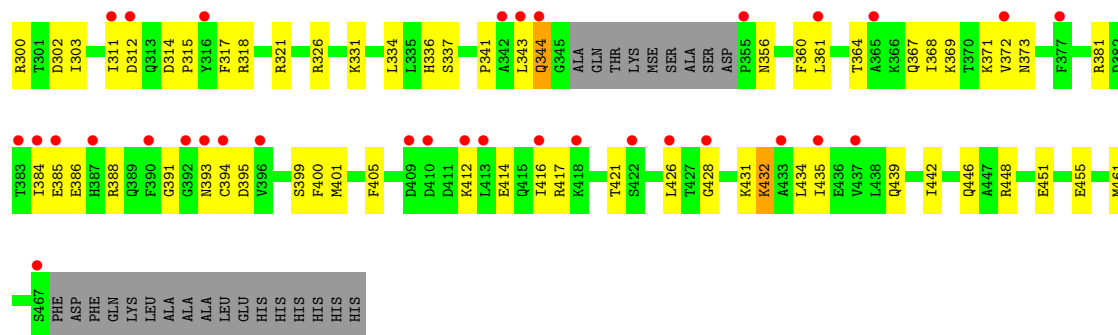


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
3	A	1	6	3	3	0	0
3	A	1	6	3	3	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	50	50	50	0	0
4	B	50	50	50	0	0







## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	134.66Å 96.46Å 97.13Å 90.00° 129.90° 90.00°	Depositor
Resolution (Å)	30.00 – 2.00 30.00 – 2.00	Depositor EDS
% Data completeness (in resolution range)	(Not available) (30.00-2.00) 93.6 (30.00-2.00)	Depositor EDS
$R_{merge}$	0.04	Depositor
$R_{sym}$	0.04	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.60 (at 2.00Å)	Xtrriage
Refinement program	CNS	Depositor
R, $R_{free}$	0.254 , 0.297 0.240 , 0.280	Depositor DCC
$R_{free}$ test set	3154 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	37.7	Xtrriage
Anisotropy	0.181	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 46.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	6205	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	50.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.56% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 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: GOL, TYM

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	0.38	0/3195	0.62	1/4297 (0.0%)
1	B	0.36	0/2988	0.58	0/4014
All	All	0.37	0/6183	0.60	1/8311 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	430	LEU	N-CA-C	-8.34	88.49	111.00

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	3129	0	3075	131	0
1	B	2927	0	2893	108	0
2	A	37	0	23	3	0
3	A	12	0	14	2	0
4	A	50	0	0	4	0
4	B	50	0	0	3	0
All	All	6205	0	6005	236	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 19.

The worst 5 of 236 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:429:GLU:HB3	1:A:432:LYS:HB2	1.18	1.12
1:A:95:ALA:HA	1:A:347:GLN:NE2	1.88	0.89
1:A:416:ILE:HA	1:A:425:MSE:HE1	1.56	0.86
1:B:250:ASN:HD21	1:B:291:ASN:ND2	1.74	0.86
1:B:143:MSE:HE3	1:B:146:VAL:HB	1.57	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	386/437 (88%)	360 (93%)	20 (5%)	6 (2%)	<b>8</b> <b>3</b>
1	B	358/437 (82%)	336 (94%)	18 (5%)	4 (1%)	<b>12</b> <b>7</b>
All	All	744/874 (85%)	696 (94%)	38 (5%)	10 (1%)	<b>10</b> <b>5</b>

5 of 10 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	168	ALA
1	A	381	ARG
1	A	429	GLU
1	A	355	PRO
1	B	134	ARG

### 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	343/369 (93%)	330 (96%)	13 (4%)	28	28
1	B	320/369 (87%)	313 (98%)	7 (2%)	47	51
All	All	663/738 (90%)	643 (97%)	20 (3%)	36	37

5 of 20 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	236	SER
1	B	344	GLN
1	B	455	GLU
1	B	432	LYS
1	A	236	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 17 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	291	ASN
1	B	356	ASN
1	A	415	GLN
1	A	446	GLN
1	B	118	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](#)

3 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	GOL	A	602	-	5,5,5	0.33	0	5,5,5	1.94	3 (60%)
3	GOL	A	601	-	5,5,5	0.39	0	5,5,5	1.96	3 (60%)
2	TYM	A	501	-	35,41,41	1.01	3 (8%)	38,61,61	0.84	1 (2%)

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	GOL	A	602	-	-	2/4/4/4	-
3	GOL	A	601	-	-	3/4/4/4	-
2	TYM	A	501	-	-	2/16/39/39	0/5/5/5

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	501	TYM	CZ3-CE3	2.56	1.42	1.36
2	A	501	TYM	C2-N3	2.37	1.35	1.32
2	A	501	TYM	CH2-CZ3	2.36	1.43	1.38

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	601	GOL	C3-C2-C1	2.78	121.99	111.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	602	GOL	C3-C2-C1	2.55	121.13	111.80
3	A	602	GOL	O2-C2-C1	2.52	119.61	109.18
3	A	601	GOL	O2-C2-C1	2.45	119.32	109.18
3	A	602	GOL	O2-C2-C3	2.43	119.26	109.18

There are no chirality outliers.

5 of 7 torsion outliers are listed below:

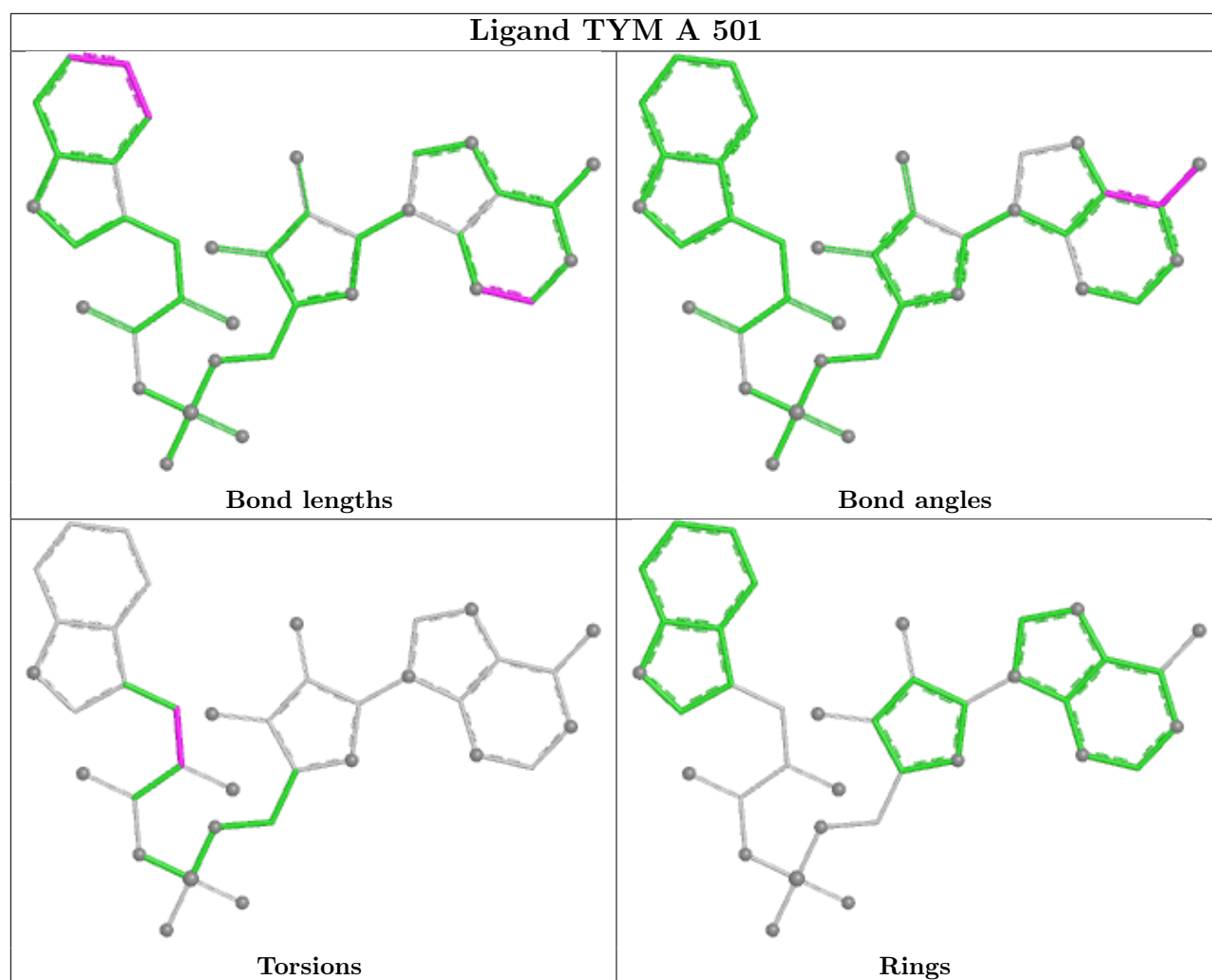
Mol	Chain	Res	Type	Atoms
3	A	602	GOL	O1-C1-C2-C3
3	A	602	GOL	C1-C2-C3-O3
3	A	601	GOL	O1-C1-C2-C3
3	A	601	GOL	O2-C2-C3-O3
2	A	501	TYM	C-CA-CB-CG

There are no ring outliers.

3 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	602	GOL	1	0
3	A	601	GOL	1	0
2	A	501	TYM	3	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



## 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](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	378/437 (86%)	1.11	77 (20%) 3 3	22, 49, 75, 84	11 (2%)
1	B	353/437 (80%)	1.08	72 (20%) 3 3	20, 51, 77, 88	6 (1%)
All	All	731/874 (83%)	1.10	149 (20%) 3 3	20, 50, 75, 88	17 (2%)

The worst 5 of 149 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	98	ILE	8.4
1	A	168	ALA	6.5
1	B	98	ILE	5.5
1	A	97	GLY	5.4
1	B	97	GLY	4.7

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

### 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

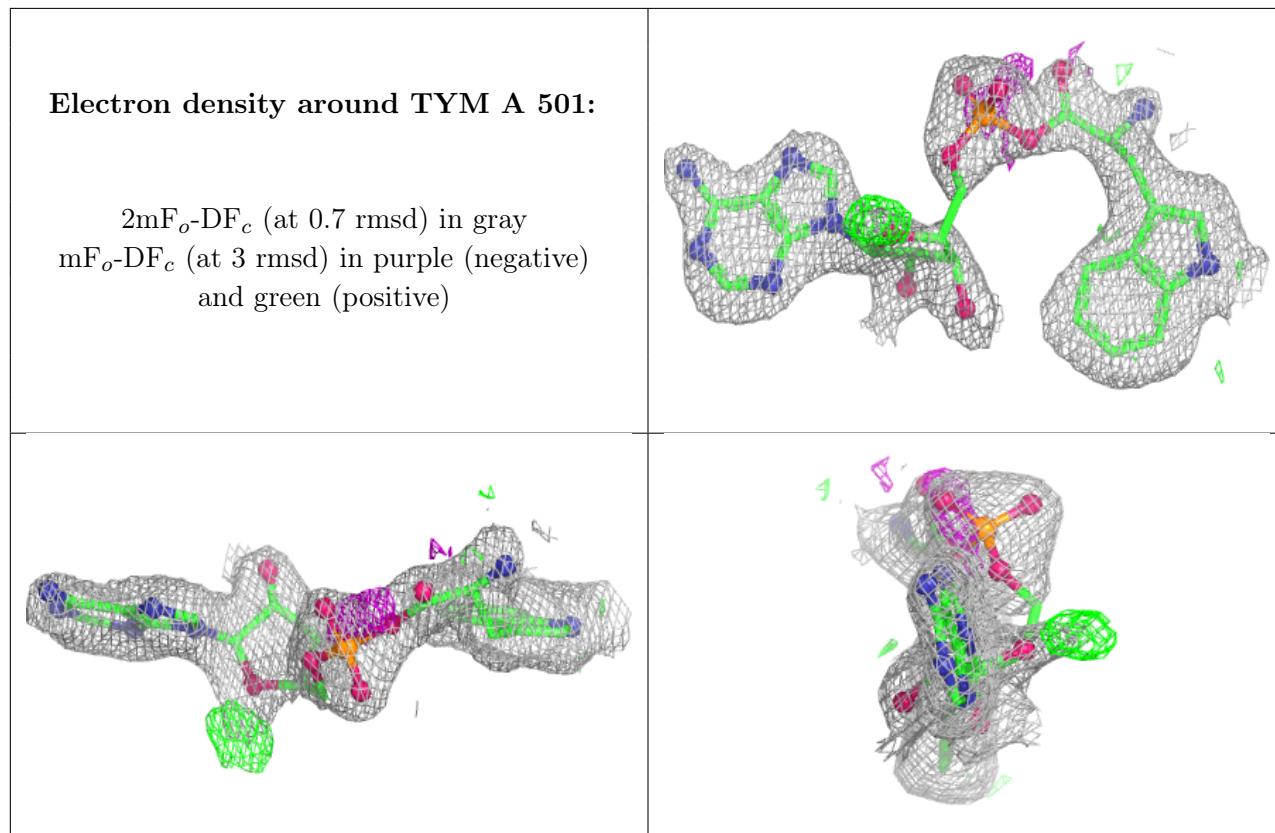
### 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists the number of atoms with occupancy less than 0.9.



Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	GOL	A	601	6/6	0.68	0.22	52,54,54,55	0
3	GOL	A	602	6/6	0.71	0.18	55,57,57,57	0
2	TYM	A	501	37/37	0.85	0.16	45,53,60,60	8

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



## 6.5 Other polymers [\(i\)](#)

There are no such residues in this entry.