



# wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 22, 2023 – 05:04 AM EDT

PDB ID : 2Q43  
Title : Ensemble refinement of the protein crystal structure of IAA-aminoacid hydro-  
lase from Arabidopsis thaliana gene At5g56660  
Authors : Levin, E.J.; Kondrashov, D.A.; Wesenberg, G.E.; Phillips Jr., G.N.; Center for  
Eukaryotic Structural Genomics (CESG)  
Deposited on : 2007-05-31  
Resolution : 2.00 Å(reported)

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We welcome your comments at [validation@mail.wwpdb.org](mailto: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 ⓘ 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  
Xtriage (Phenix) : 1.13  
EDS : 2.35  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.35

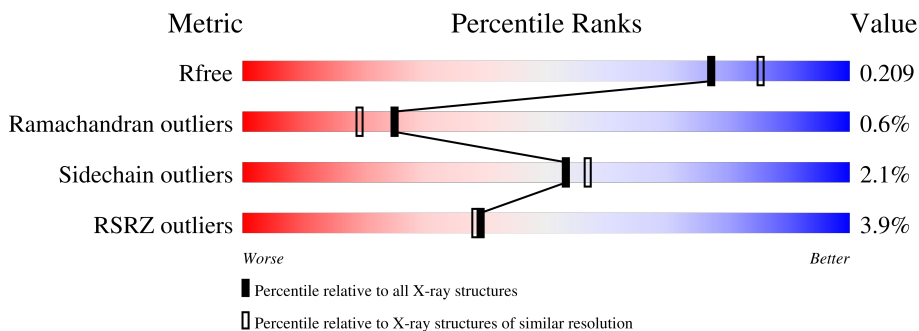
# 1 Overall quality at a glance

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.



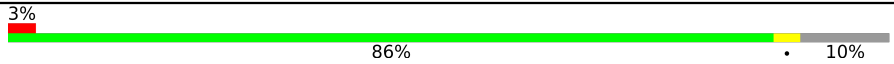

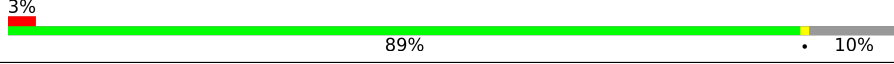
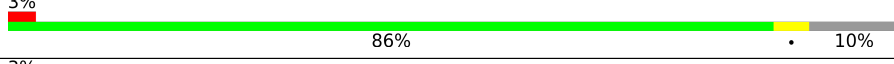
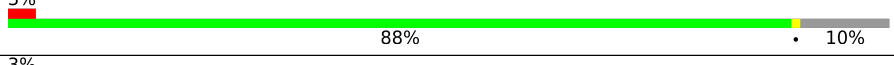
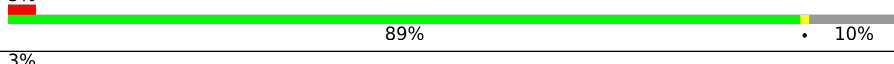
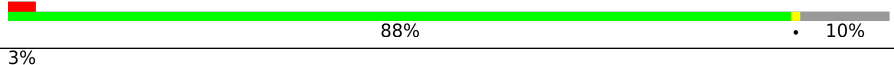
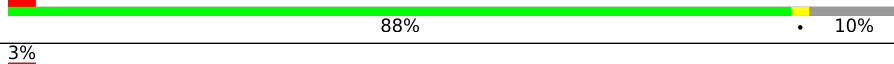
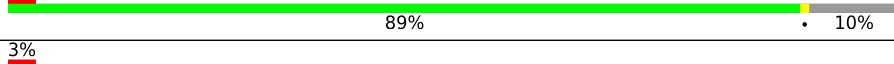
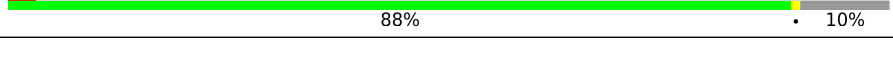
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	8085 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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	1-A	418	
1	10-A	418	
1	11-A	418	
1	12-A	418	
1	13-A	418	
1	14-A	418	

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Mol	Chain	Length	Quality of chain
1	15-A	418	 3% 86% 10%
1	16-A	418	 3% 85% 10%
1	2-A	418	 3% 89% 10%
1	3-A	418	 3% 86% 10%
1	4-A	418	 3% 88% 10%
1	5-A	418	 3% 89% 10%
1	6-A	418	 3% 88% 10%
1	7-A	418	 3% 88% 10%
1	8-A	418	 3% 89% 10%
1	9-A	418	 3% 88% 10%

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 50784 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 IAA-amino acid hydrolase ILR1-like 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	1-A	375	2889	1841	501	536	11	0	0	0
1	2-A	375	2889	1841	501	536	11	0	0	0
1	3-A	375	2889	1841	501	536	11	0	0	0
1	4-A	375	2889	1841	501	536	11	0	0	0
1	5-A	375	2889	1841	501	536	11	0	0	0
1	6-A	375	2889	1841	501	536	11	0	0	0
1	7-A	375	2889	1841	501	536	11	0	0	0
1	8-A	375	2889	1841	501	536	11	0	0	0
1	9-A	375	2889	1841	501	536	11	0	0	0
1	10-A	375	2889	1841	501	536	11	0	0	0
1	11-A	375	2889	1841	501	536	11	0	0	0
1	12-A	375	2889	1841	501	536	11	0	0	0
1	13-A	375	2889	1841	501	536	11	0	0	0
1	14-A	375	2889	1841	501	536	11	0	0	0
1	15-A	375	2889	1841	501	536	11	0	0	0
1	16-A	375	2889	1841	501	536	11	0	0	0

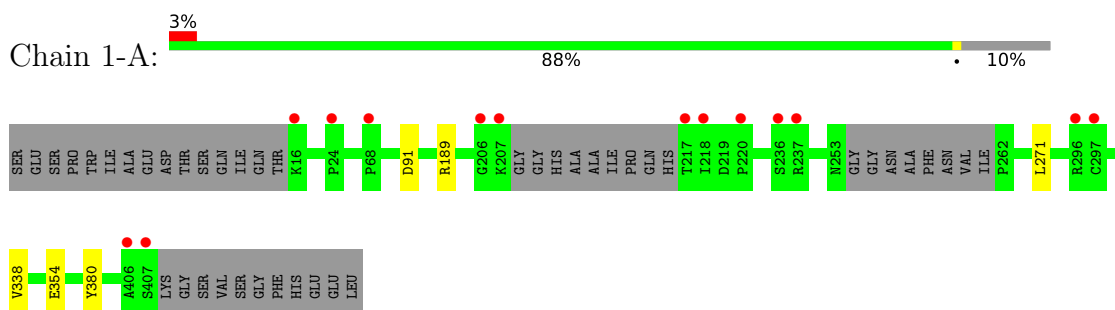
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	1-A	285	Total O 285 285	0	0
2	2-A	285	Total O 285 285	0	0
2	3-A	285	Total O 285 285	0	0
2	4-A	285	Total O 285 285	0	0
2	5-A	285	Total O 285 285	0	0
2	6-A	285	Total O 285 285	0	0
2	7-A	285	Total O 285 285	0	0
2	8-A	285	Total O 285 285	0	0
2	9-A	285	Total O 285 285	0	0
2	10-A	285	Total O 285 285	0	0
2	11-A	285	Total O 285 285	0	0
2	12-A	285	Total O 285 285	0	0
2	13-A	285	Total O 285 285	0	0
2	14-A	285	Total O 285 285	0	0
2	15-A	285	Total O 285 285	0	0
2	16-A	285	Total O 285 285	0	0

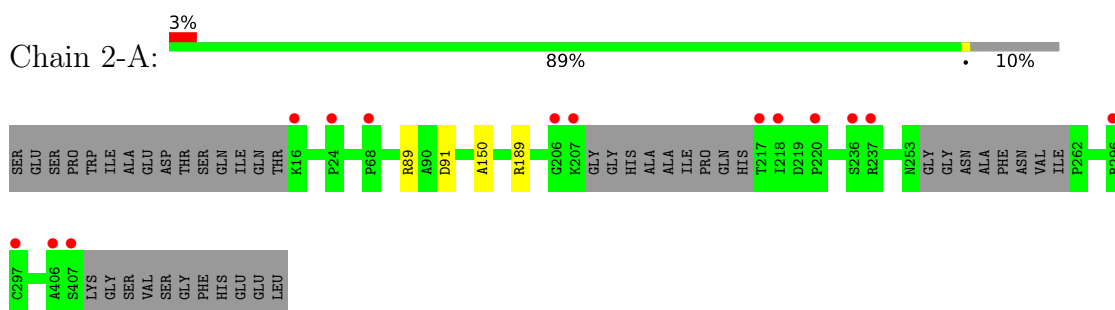
### 3 Residue-property plots [i](#)

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 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.

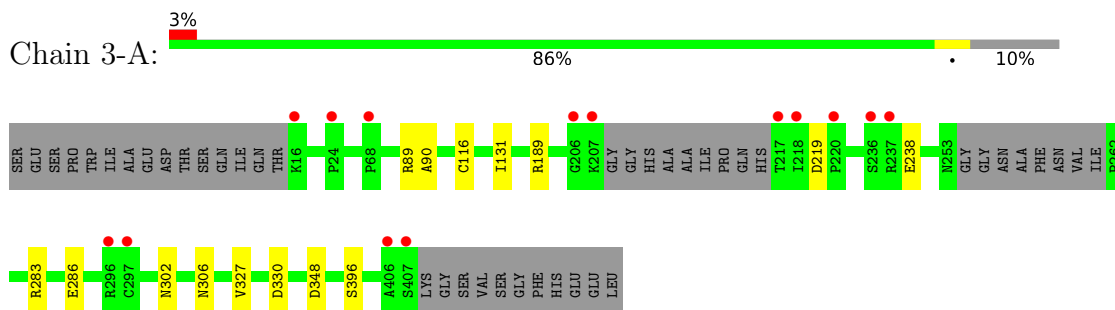
- Molecule 1: IAA-amino acid hydrolase ILR1-like 2



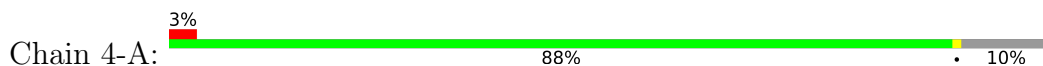
- Molecule 1: IAA-amino acid hydrolase ILR1-like 2

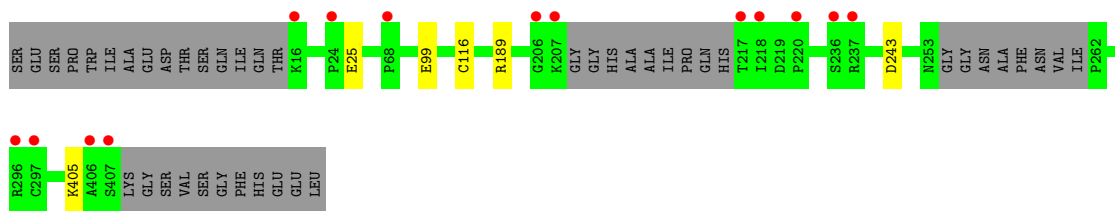


- Molecule 1: IAA-amino acid hydrolase ILR1-like 2

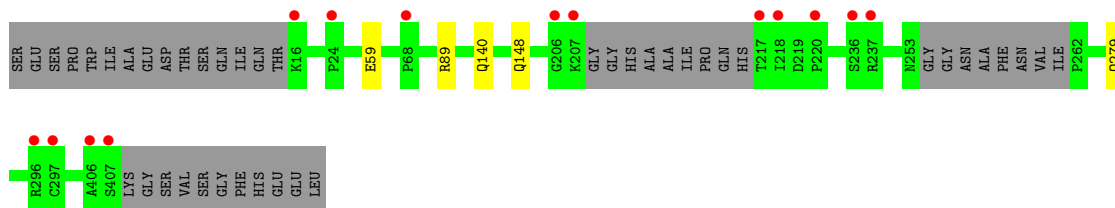
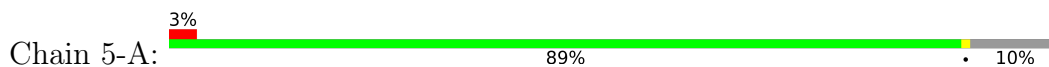


- Molecule 1: IAA-amino acid hydrolase ILR1-like 2

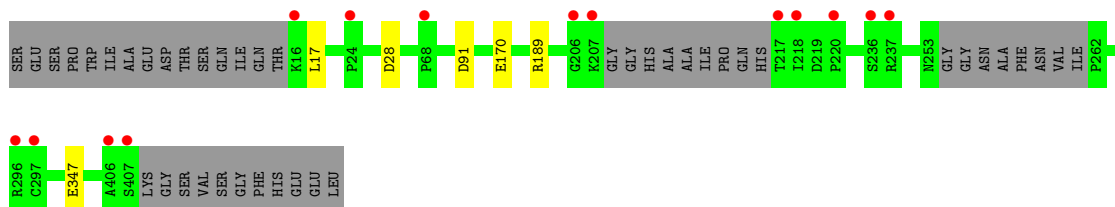
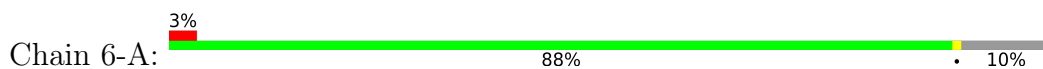




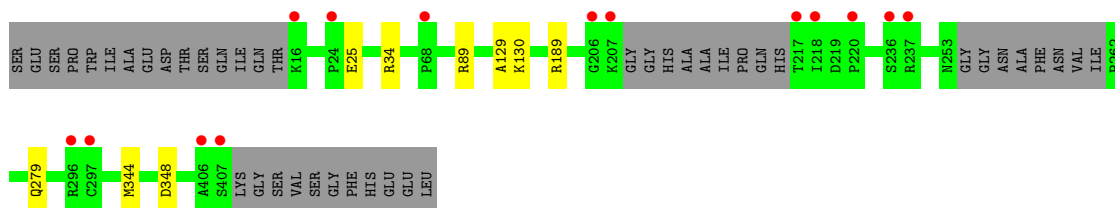
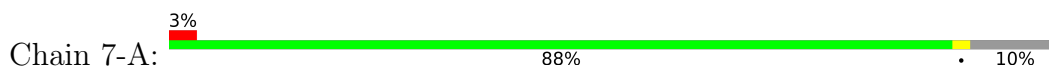
- Molecule 1: IAA-amino acid hydrolase ILR1-like 2



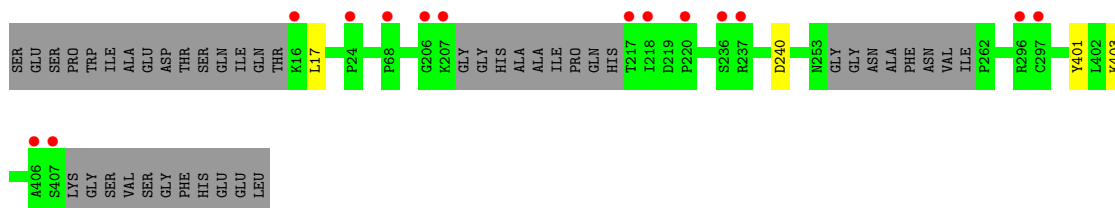
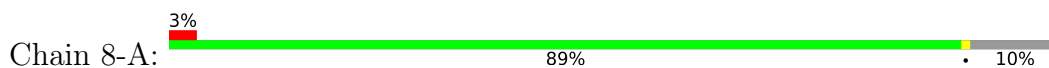
- Molecule 1: IAA-amino acid hydrolase ILR1-like 2



- Molecule 1: IAA-amino acid hydrolase ILR1-like 2

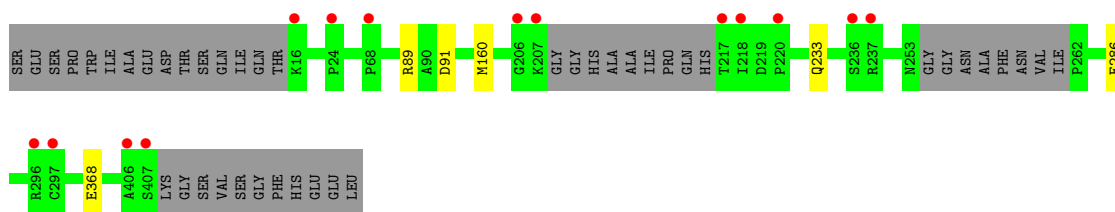


- Molecule 1: IAA-amino acid hydrolase ILR1-like 2



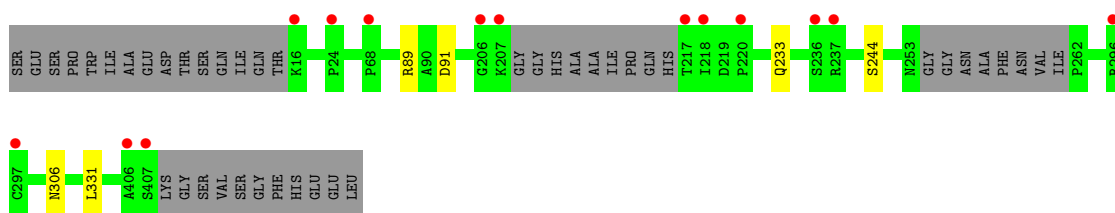
- Molecule 1: IAA-amino acid hydrolase ILR1-like 2

Chain 9-A: 3% 88% 10%



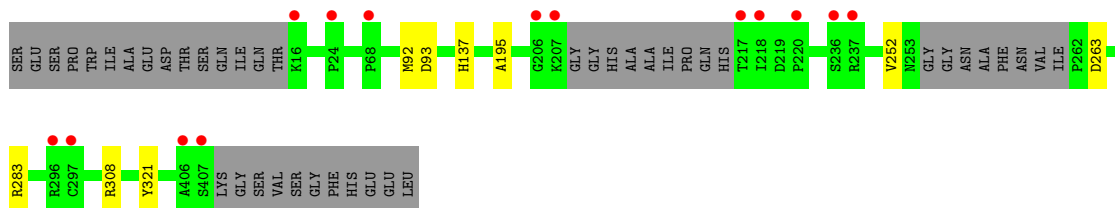
- Molecule 1: IAA-amino acid hydrolase ILR1-like 2

Chain 10-A: 3% 88% 10%



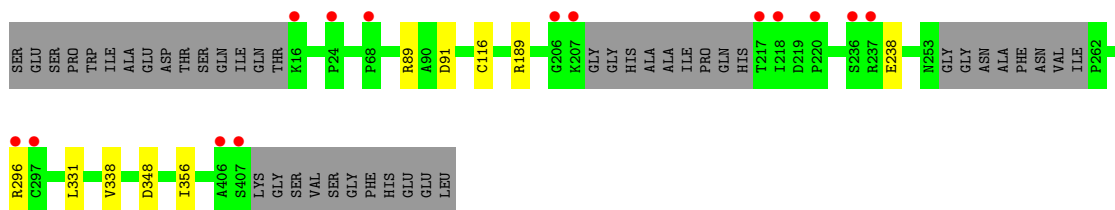
- Molecule 1: IAA-amino acid hydrolase ILR1-like 2

Chain 11-A: 3% 88% 10%



- Molecule 1: IAA-amino acid hydrolase ILR1-like 2

Chain 12-A: 3% 87% 10%



- Molecule 1: IAA-amino acid hydrolase ILR1-like 2

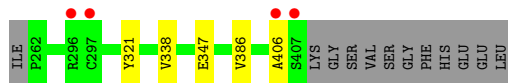
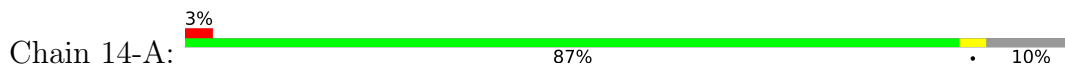
Chain 13-A: 3% 87% 10%



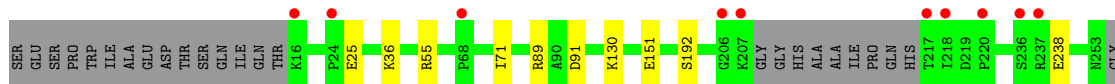
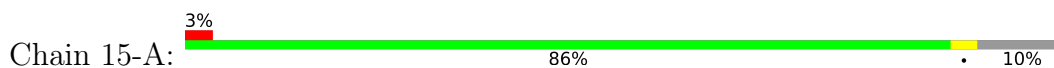




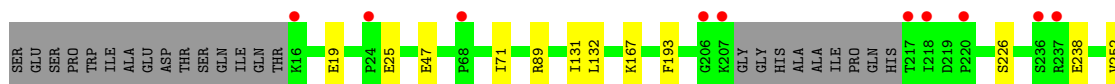
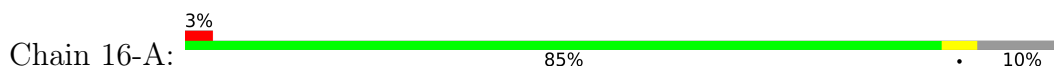
- Molecule 1: IAA-amino acid hydrolase ILR1-like 2



- Molecule 1: IAA-amino acid hydrolase ILR1-like 2



- Molecule 1: IAA-amino acid hydrolase ILR1-like 2



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	75.26Å 75.26Å 130.88Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	23.09 – 2.00 24.21 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.8 (23.09-2.00) 99.9 (24.21-2.00)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.16 (at 1.99Å)	Xtrriage
Refinement program	CNS 1.1	Depositor
R, $R_{free}$	0.149 , 0.204 0.157 , 0.209	Depositor DCC
$R_{free}$ test set	1504 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	28.4	Xtrriage
Anisotropy	0.041	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.26 , 68.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.027 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	50784	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.88% 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

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	1-A	0.45	0/2948	0.63	0/3984
1	2-A	0.45	0/2948	0.63	0/3984
1	3-A	0.45	0/2948	0.63	0/3984
1	4-A	0.45	0/2948	0.63	0/3984
1	5-A	0.46	0/2948	0.62	0/3984
1	6-A	0.46	0/2948	0.62	0/3984
1	7-A	0.46	0/2948	0.61	0/3984
1	8-A	0.46	0/2948	0.61	0/3984
1	9-A	0.45	0/2948	0.61	0/3984
1	10-A	0.46	0/2948	0.62	0/3984
1	11-A	0.45	0/2948	0.62	0/3984
1	12-A	0.44	0/2948	0.62	0/3984
1	13-A	0.54	0/2948	0.70	0/3984
1	14-A	0.52	0/2948	0.71	1/3984 (0.0%)
1	15-A	0.52	0/2948	0.70	0/3984
1	16-A	0.51	0/2948	0.70	0/3984
All	All	0.47	0/47168	0.64	1/63744 (0.0%)

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	16-A	0	1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	14-A	189	ARG	NE-CZ-NH1	-5.11	117.74	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	16-A	321	TYR	Sidechain

## 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	1-A	2889	0	2919	0	0
1	2-A	2889	0	2919	0	0
1	3-A	2889	0	2919	0	0
1	4-A	2889	0	2919	0	0
1	5-A	2889	0	2919	0	0
1	6-A	2889	0	2919	0	0
1	7-A	2889	0	2919	0	0
1	8-A	2889	0	2919	0	0
1	9-A	2889	0	2919	0	0
1	10-A	2889	0	2919	0	0
1	11-A	2889	0	2919	0	0
1	12-A	2889	0	2919	0	0
1	13-A	2889	0	2919	0	0
1	14-A	2889	0	2919	0	0
1	15-A	2889	0	2919	0	0
1	16-A	2889	0	2919	0	0
2	1-A	285	0	0	0	0
2	2-A	285	0	0	0	0
2	3-A	285	0	0	0	0
2	4-A	285	0	0	0	0
2	5-A	285	0	0	0	0
2	6-A	285	0	0	0	0
2	7-A	285	0	0	0	0
2	8-A	285	0	0	0	0
2	9-A	285	0	0	0	0
2	10-A	285	0	0	0	0
2	11-A	285	0	0	0	0
2	12-A	285	0	0	0	0
2	13-A	285	0	0	0	0
2	14-A	285	0	0	0	0
2	15-A	285	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	16-A	285	0	0	0	0
All	All	50784	0	46704	0	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). Clashscore could not be calculated for this entry.

There are no clashes within the asymmetric unit.

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	1-A	369/418 (88%)	348 (94%)	20 (5%)	1 (0%)	41	37
1	2-A	369/418 (88%)	348 (94%)	20 (5%)	1 (0%)	41	37
1	3-A	369/418 (88%)	338 (92%)	27 (7%)	4 (1%)	14	8
1	4-A	369/418 (88%)	354 (96%)	15 (4%)	0	100	100
1	5-A	369/418 (88%)	357 (97%)	12 (3%)	0	100	100
1	6-A	369/418 (88%)	352 (95%)	17 (5%)	0	100	100
1	7-A	369/418 (88%)	340 (92%)	27 (7%)	2 (0%)	29	23
1	8-A	369/418 (88%)	354 (96%)	13 (4%)	2 (0%)	29	23
1	9-A	369/418 (88%)	356 (96%)	13 (4%)	0	100	100
1	10-A	369/418 (88%)	355 (96%)	13 (4%)	1 (0%)	41	37
1	11-A	369/418 (88%)	348 (94%)	16 (4%)	5 (1%)	11	5
1	12-A	369/418 (88%)	345 (94%)	23 (6%)	1 (0%)	41	37
1	13-A	369/418 (88%)	341 (92%)	23 (6%)	5 (1%)	11	5
1	14-A	369/418 (88%)	349 (95%)	16 (4%)	4 (1%)	14	8
1	15-A	369/418 (88%)	347 (94%)	21 (6%)	1 (0%)	41	37
1	16-A	369/418 (88%)	340 (92%)	21 (6%)	8 (2%)	6	2

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	5904/6688 (88%)	5572 (94%)	297 (5%)	35 (1%)	25 19

5 of 35 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	2-A	150	ALA
1	11-A	195	ALA
1	11-A	263	ASP
1	11-A	308	ARG
1	13-A	373	ALA

### 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	1-A	308/341 (90%)	303 (98%)	5 (2%)	62 67
1	2-A	308/341 (90%)	305 (99%)	3 (1%)	76 81
1	3-A	308/341 (90%)	297 (96%)	11 (4%)	35 34
1	4-A	308/341 (90%)	302 (98%)	6 (2%)	57 61
1	5-A	308/341 (90%)	303 (98%)	5 (2%)	62 67
1	6-A	308/341 (90%)	302 (98%)	6 (2%)	57 61
1	7-A	308/341 (90%)	301 (98%)	7 (2%)	50 53
1	8-A	308/341 (90%)	306 (99%)	2 (1%)	86 90
1	9-A	308/341 (90%)	302 (98%)	6 (2%)	57 61
1	10-A	308/341 (90%)	303 (98%)	5 (2%)	62 67
1	11-A	308/341 (90%)	304 (99%)	4 (1%)	69 74
1	12-A	308/341 (90%)	299 (97%)	9 (3%)	42 43
1	13-A	308/341 (90%)	300 (97%)	8 (3%)	46 48
1	14-A	308/341 (90%)	302 (98%)	6 (2%)	57 61
1	15-A	308/341 (90%)	295 (96%)	13 (4%)	30 27
1	16-A	308/341 (90%)	299 (97%)	9 (3%)	42 43

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	4928/5456 (90%)	4823 (98%)	105 (2%)	53 57

5 of 105 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	11-A	93	ASP
1	13-A	193	PHE
1	16-A	193	PHE
1	11-A	321	TYR
1	12-A	296	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 117 such sidechains are listed below:

Mol	Chain	Res	Type
1	9-A	370	ASN
1	16-A	233	GLN
1	11-A	370	ASN
1	16-A	168	ASN
1	14-A	376	HIS

### 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](#)

There are no ligands in this entry.

## 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	1-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	2-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	3-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	4-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	5-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	6-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	7-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	8-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	9-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	10-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	11-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	12-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	13-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	14-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	15-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
1	16-A	375/418 (89%)	-0.20	14 (3%) 41 41	10, 23, 47, 66	375 (100%)
All	All	6000/6688 (89%)	-0.20	224 (3%) 39 41	10, 23, 48, 66	6000 (100%)

The worst 5 of 224 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	1-A	218	ILE	5.5
1	2-A	218	ILE	5.5
1	3-A	218	ILE	5.5
1	4-A	218	ILE	5.5
1	5-A	218	ILE	5.5

## 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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.