



wwPDB EM Validation Summary Report ⓘ

Dec 21, 2025 – 11:36 PM JST

PDB ID : 9V55 / pdb_00009v55
EMDB ID : EMD-64787
Title : Structure of TolC, YbjP, and AcrA complex
Authors : Ge, X.F.; Gu, Z.W.; Wang, J.W.
Deposited on : 2025-05-25
Resolution : 3.26 Å(reported)

This is a wwPDB EM 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/EMValidationReportHelp>

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>.

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

EMDB validation analysis : **FAILED**
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
EM percentile statistics : **NOT EXECUTED**
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.47

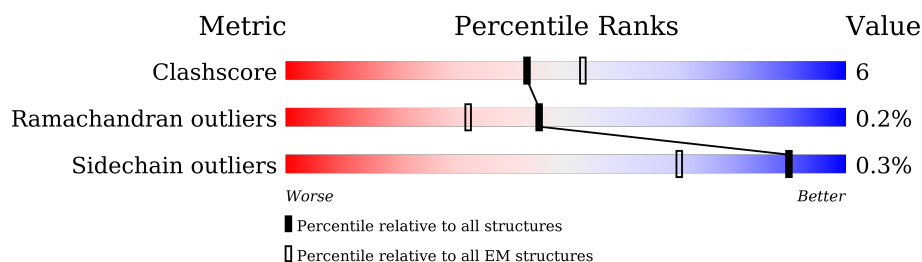
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.26 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	C1	493	76% 12% 12%
1	C2	493	74% 14% 12%
1	C3	493	73% 14% 12%
2	P1	171	63% 26% 11%
2	P2	171	67% 22% • 11%
2	P3	171	67% 21% • 11%
3	A1	397	75% 12% 13%
3	A2	397	75% 12% 13%
3	A3	397	73% 14% 13%

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Mol	Chain	Length	Quality of chain
3	a1	397	 74% 12% 13%
3	a2	397	 76% 11% 13%
3	a3	397	 77% 10% 13%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 29061 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Outer membrane protein TolC.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	C1	432	Total	C	N	O	S	0	0
			3331	2054	591	681	5		
1	C2	432	Total	C	N	O	S	0	0
			3331	2054	591	681	5		
1	C3	432	Total	C	N	O	S	0	0
			3331	2054	591	681	5		

- Molecule 2 is a protein called Uncharacterized lipoprotein YbjP.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	P1	152	Total	C	N	O	S	0	0
			1182	722	218	238	4		
2	P2	152	Total	C	N	O	S	0	0
			1182	722	218	238	4		
2	P3	152	Total	C	N	O	S	0	0
			1182	722	218	238	4		

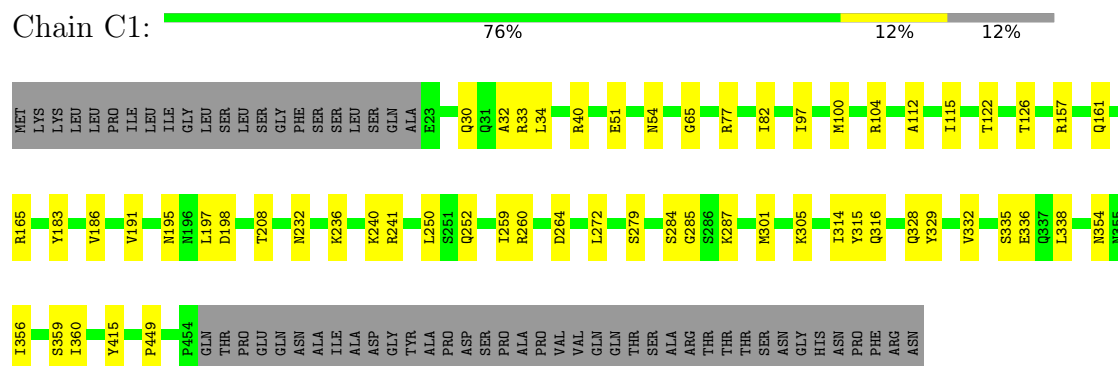
- Molecule 3 is a protein called Multidrug efflux pump subunit AcrA.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	A1	344	Total	C	N	O	S	0	0
			2587	1617	456	512	2		
3	A2	344	Total	C	N	O	S	0	0
			2587	1617	456	512	2		
3	A3	344	Total	C	N	O	S	0	0
			2587	1617	456	512	2		
3	a2	344	Total	C	N	O	S	0	0
			2587	1617	456	512	2		
3	a1	344	Total	C	N	O	S	0	0
			2587	1617	456	512	2		
3	a3	344	Total	C	N	O	S	0	0
			2587	1617	456	512	2		

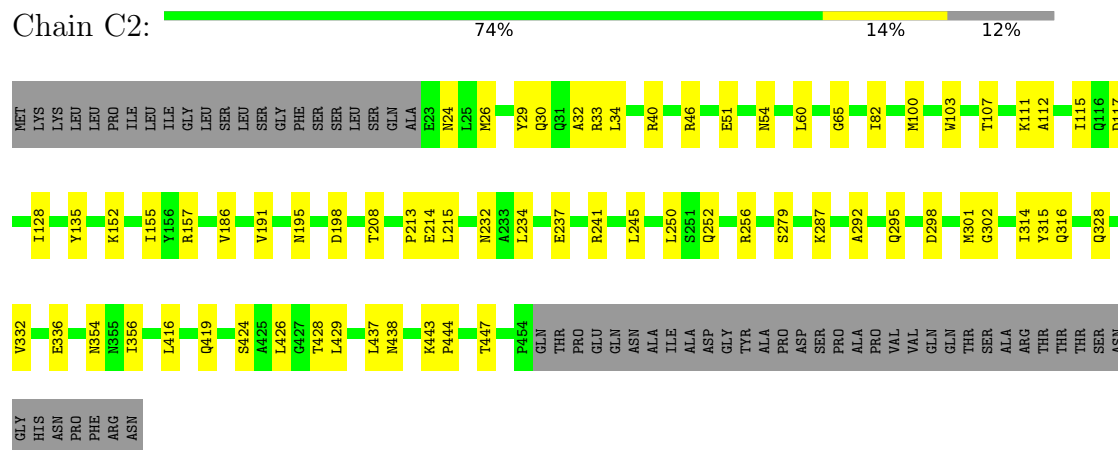
3 Residue-property plots

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.

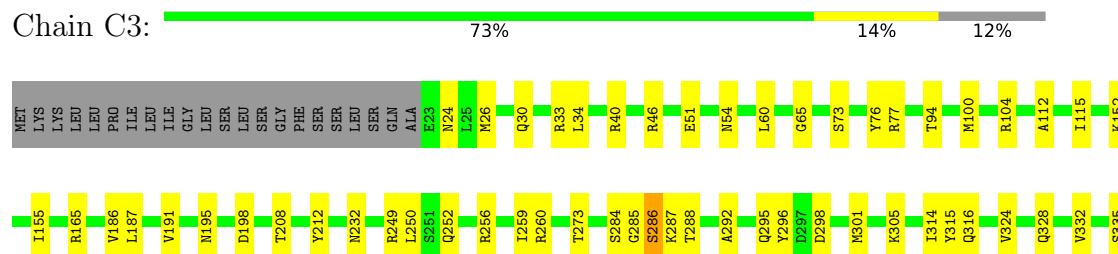
- Molecule 1: Outer membrane protein TolC

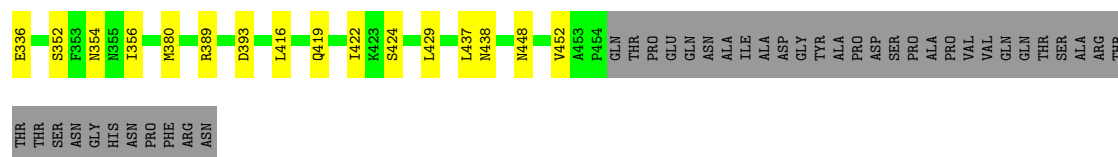


- Molecule 1: Outer membrane protein TolC



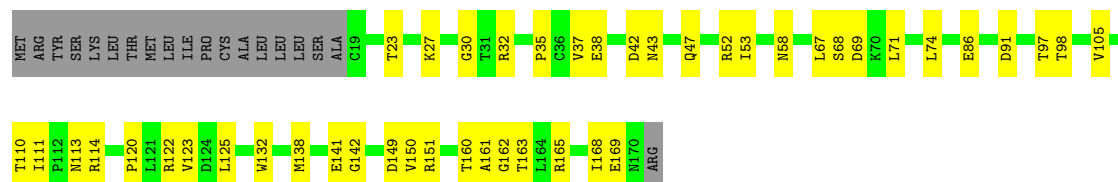
- Molecule 1: Outer membrane protein TolC





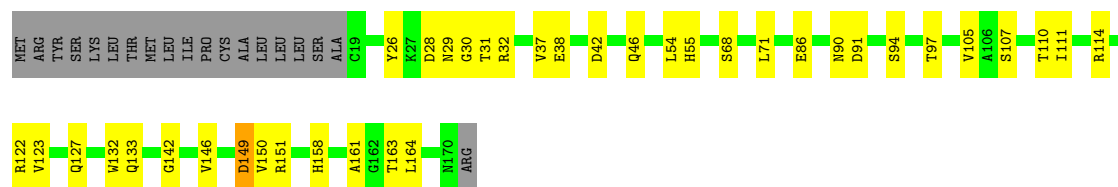
- Molecule 2: Uncharacterized lipoprotein YbjP

Chain P1: 63% 26% 11%



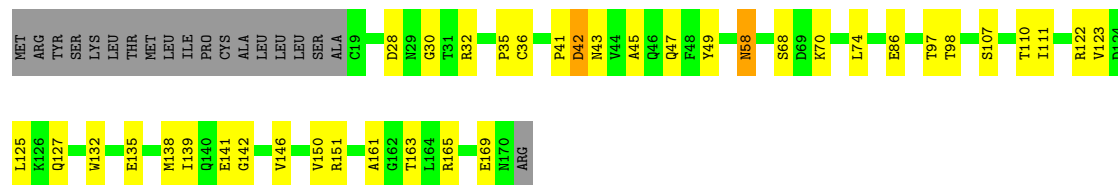
- Molecule 2: Uncharacterized lipoprotein YbjP

Chain P2: 67% 22% 11%



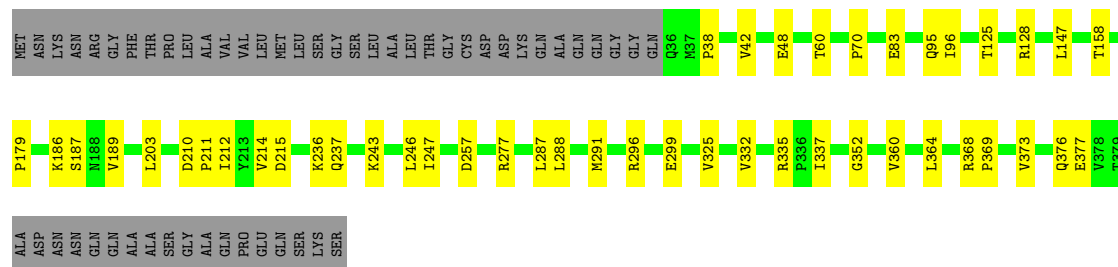
- Molecule 2: Uncharacterized lipoprotein YbjP

Chain P3: 67% 21% 11%



- Molecule 3: Multidrug efflux pump subunit AcrA

Chain A1: 75% 12% 13%



- Molecule 3: Multidrug efflux pump subunit AcrA

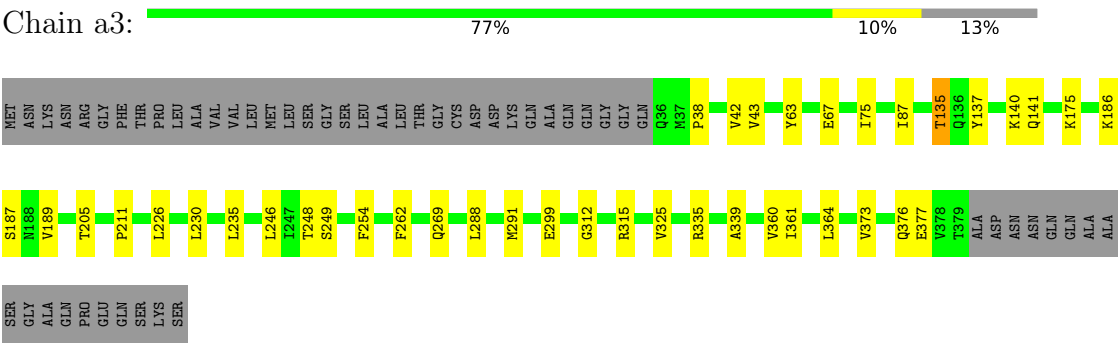
Protein		Residue		Mutation		Effect		Frequency		Conservation		Pathway		Function		Disease		Phenotype		Genotype		Expression		Localization		Interaction		Structure		Stability		Activity		Regulation		Signaling		Metabolism		Development		Evolution		Taxonomy		Phylogeny		Biophysics		Biochemistry		Molecular Biology		Cell Biology		Physiology		Pathology		Therapeutics		Diagnostics		Prognosis		Prevention		Treatment		Outcome		Quality of Life		Healthcare		Public Health		Policy		Ethics		Society		Culture		Economy		Environment		Climate Change		Biodiversity		Conservation		Sustainability		Innovation		Education		Research		Funding		Collaboration		Communication		Outreach		Engagement		Participation		Leadership		Governance		Accountability		Transparency		Integrity		Trust		Resilience		Adaptability		Inclusivity		Equity		Justice		Peace		Security		Stability		Growth		Prosperity		Well-being		Happiness		Meaning		Purpose		Values		Norms		Customs		Traditions		Beliefs		Attitudes		Behaviors		Lifestyles		Preferences		Needs		Wants		Goals		Dreams		Vision		Mission		Vision Statement		Core Values		Strategic Pillars		Key Objectives		Performance Indicators		Success Metrics		Key Results		Impact		Legacy		Contribution		Influence		Reputation		Brand Equity		Market Share		Competitive Advantage		Sustainability		Resilience		Adaptability		Inclusivity		Equity		Justice		Peace		Security		Stability		Growth		Prosperity		Well-being		Happiness		Meaning		Purpose		Values		Norms		Customs		Traditions		Beliefs		Attitudes		Behaviors		Lifestyles		Preferences		Needs		Wants		Goals		Dreams		Vision		Mission		Vision Statement		Core Values		Strategic Pillars		Key Objectives		Performance Indicators		Success Metrics		Key Results		Impact		Legacy		Contribution		Influence		Reputation		Brand Equity		Market Share		Competitive Advantage		Sustainability		Resilience		Adaptability		Inclusivity		Equity		Justice		Peace		Security		Stability		Growth		Prosperity		Well-being		Happiness		Meaning		Purpose		Values		Norms		Customs		Traditions		Beliefs		Attitudes		Behaviors		Lifestyles		Preferences		Needs		Wants		Goals		Dreams		Vision		Mission		Vision Statement		Core Values		Strategic Pillars		Key Objectives		Performance Indicators		Success Metrics		Key Results		Impact		Legacy		Contribution		Influence		Reputation		Brand Equity		Market Share		Competitive Advantage		Sustainability		Resilience		Adaptability		Inclusivity		Equity		Justice		Peace		Security		Stability		Growth		Prosperity		Well-being		Happiness		Meaning		Purpose		Values		Norms		Customs		Traditions		Beliefs		Attitudes		Behaviors		Lifestyles		Preferences		Needs		Wants		Goals		Dreams		Vision		Mission		Vision Statement		Core Values		Strategic Pillars		Key Objectives		Performance Indicators		Success Metrics		Key Results		Impact		Legacy		Contribution		Influence		Reputation		Brand Equity		Market Share		Competitive Advantage		Sustainability		Resilience		Adaptability		Inclusivity		Equity		Justice		Peace		Security		Stability		Growth		Prosperity		Well-being		Happiness		Meaning		Purpose		Values		Norms		Customs		Traditions		Beliefs		Attitudes		Behaviors		Lifestyles		Preferences		Needs		Wants		Goals		Dreams		Vision		Mission		Vision Statement		Core Values		Strategic Pillars		Key Objectives		Performance Indicators		Success Metrics		Key Results		Impact		Legacy		Contribution		Influence		Reputation		Brand Equity		Market Share		Competitive Advantage		Sustainability		Resilience		Adaptability		Inclusivity		Equity		Justice		Peace		Security		Stability		Growth		Prosperity		Well-being		Happiness		Meaning		Purpose		Values		Norms		Customs		Traditions		Beliefs		Attitudes		Behaviors		Lifestyles		Preferences		Needs		Wants		Goals		Dreams		Vision		Mission		Vision Statement		Core Values		Strategic Pillars		Key Objectives		Performance Indicators		Success Metrics		Key Results		Impact		Legacy		Contribution		Influence		Reputation		Brand Equity		Market Share		Competitive Advantage		Sustainability		Resilience		Adaptability		Inclusivity		Equity		Justice		Peace		Security		Stability		Growth		Prosperity		Well-being		Happiness		Meaning		Purpose		Values		Norms		Customs		Traditions		Beliefs		Attitudes		Behaviors		Lifestyles		Preferences		Needs		Wants		Goals		Dreams		Vision		Mission		Vision Statement		Core Values		Strategic Pillars		Key Objectives		Performance Indicators		Success Metrics		Key Results		Impact		Legacy		Contribution		Influence	
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R294	L124	ASN	MET
T314	T125	ASN	LYS
R315	R128	ASN	GLY
V325	L132	THR	THR
R335	Q141	PRO	PRO
R358	A148	LEU	LEU
Q376	Q152	VAL	ALA
T379	E165	LEU	VAL
ALA	R168	MET	LEU
ASP	T174	LEU	LEU
ASN	K175	GLY	GLY
ASN	K186	LEU	SER
GLN	L187	ALA	GLN
GLN	S188	LEU	ALA
ALA	V189	THR	THR
SER	L194	GLY	GLY
GLY	G198	ASP	CYS
ALA	L203	ASP	ASP
GLN	D210	LYS	GLN
SER	P211	GLN	GLN
LYS	I212	GLN	GLY
SER	Q218	GLN	GLY
	L230		Q36
	L235		A39
	K243		V42
	F254		I52
	P255		E55
	Q256		L56
	D257		B59
	T266		P70
	V267		Q71
	D268		V72
	T271		I75
	F280		K82
	D284		E83
	H285		Q95
	T286		I96
	L287		I96

[illegible]

K374	V164	MET
A375	E165	ASN
Q376	T166	ASN
	A167	ARG
T379	R168	GLY
ALA	K186	PHE
ASP	ASN	THR
ASN	S187	PRO
GLN	N188	LEU
GLM	L189	LEU
GLN		ALA
ALA	P211	VAL
ALA		VAL
GLY	V214	LEU
GLY	G233	MET
GLM		LEU
GLN	K236	SER
PRO		GLY
GLM	K241	SER
GLN		ALA
SER	L246	LEU
LYS	T247	THR
SER	T248	GLY
SER	S249	CYS
		ASP
	F254	ASP
		LYS
	L260	GLN
	E261	ALA
	F262	GLN
	S263	GLN
	D264	GLY
	V265	GLY
		GLN
	M291	Q36
	F292	M37
	V293	P38
		A39
	R296	
		V42
	R315	
		L50
	V325	
		T53
	A339	
	T343	T60
	W347	Y63
		E67
	K354	I75
	R358	R62
	V359	
	V360	K140
		Q141
	Q365	
		A162
	V272	

● Molecule 3: Multidrug efflux pump subunit AcrA



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	17043	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TECNAI F30	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	1800	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor

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	C1	0.12	0/3373	0.26	0/4584
1	C2	0.13	0/3373	0.27	0/4584
1	C3	0.14	0/3373	0.28	0/4584
2	P1	0.13	0/1204	0.42	1/1640 (0.1%)
2	P2	0.14	0/1204	0.40	0/1640
2	P3	0.14	0/1204	0.44	0/1640
3	A1	0.12	0/2620	0.27	0/3564
3	A2	0.12	0/2620	0.26	0/3564
3	A3	0.11	0/2620	0.26	0/3564
3	a1	0.12	0/2620	0.30	0/3564
3	a2	0.12	0/2620	0.28	0/3564
3	a3	0.11	0/2620	0.27	0/3564
All	All	0.12	0/29451	0.29	1/40056 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	P1	160	THR	CB-CA-C	-5.31	110.01	117.23

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	C1	3331	0	3278	40	0
1	C2	3331	0	3278	47	0
1	C3	3331	0	3278	51	0
2	P1	1182	0	1132	28	0
2	P2	1182	0	1132	27	0
2	P3	1182	0	1132	31	0
3	A1	2587	0	2648	30	0
3	A2	2587	0	2648	32	0
3	A3	2587	0	2648	36	0
3	a1	2587	0	2648	38	0
3	a2	2587	0	2648	31	0
3	a3	2587	0	2648	24	0
All	All	29061	0	29118	374	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 6.

The worst 5 of 374 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)
3:a2:239:ASN:OD1	3:a2:240:GLY:N	2.17	0.76
2:P2:68:SER:HA	2:P2:146:VAL:HG11	1.69	0.74
3:A2:179:PRO:HB3	3:a1:75:ILE:HD11	1.72	0.72
2:P1:86:GLU:N	2:P1:86:GLU:OE1	2.22	0.71
2:P3:58:ASN:HD22	2:P3:58:ASN:C	1.99	0.71

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 PDB entries followed by that with respect to all EM entries.

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	C1	430/493 (87%)	419 (97%)	11 (3%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	C2	430/493 (87%)	422 (98%)	8 (2%)	0	100	100
1	C3	430/493 (87%)	419 (97%)	10 (2%)	1 (0%)	44	71
2	P1	150/171 (88%)	123 (82%)	25 (17%)	2 (1%)	10	35
2	P2	150/171 (88%)	126 (84%)	22 (15%)	2 (1%)	10	35
2	P3	150/171 (88%)	123 (82%)	26 (17%)	1 (1%)	19	49
3	A1	342/397 (86%)	332 (97%)	10 (3%)	0	100	100
3	A2	342/397 (86%)	330 (96%)	12 (4%)	0	100	100
3	A3	342/397 (86%)	332 (97%)	10 (3%)	0	100	100
3	a1	342/397 (86%)	335 (98%)	7 (2%)	0	100	100
3	a2	342/397 (86%)	332 (97%)	10 (3%)	0	100	100
3	a3	342/397 (86%)	333 (97%)	8 (2%)	1 (0%)	37	66
All	All	3792/4374 (87%)	3626 (96%)	159 (4%)	7 (0%)	45	71

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C3	286	SER
2	P2	150	VAL
2	P1	149	ASP
2	P1	150	VAL
2	P2	149	ASP

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 PDB entries followed by that with respect to all EM entries.

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	C1	361/412 (88%)	361 (100%)	0	100	100
1	C2	361/412 (88%)	361 (100%)	0	100	100
1	C3	361/412 (88%)	361 (100%)	0	100	100
2	P1	131/148 (88%)	130 (99%)	1 (1%)	79	86
2	P2	131/148 (88%)	130 (99%)	1 (1%)	79	86

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	P3	131/148 (88%)	129 (98%)	2 (2%)	60	75
3	A1	278/318 (87%)	277 (100%)	1 (0%)	89	92
3	A2	278/318 (87%)	277 (100%)	1 (0%)	89	92
3	A3	278/318 (87%)	278 (100%)	0	100	100
3	a1	278/318 (87%)	278 (100%)	0	100	100
3	a2	278/318 (87%)	277 (100%)	1 (0%)	89	92
3	a3	278/318 (87%)	277 (100%)	1 (0%)	89	92
All	All	3144/3588 (88%)	3136 (100%)	8 (0%)	90	94

5 of 8 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	a3	135	THR
3	a2	71	GLN
3	A1	158	THR
2	P3	58	ASN
3	A2	228	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 46 such sidechains are listed below:

Mol	Chain	Res	Type
2	P2	127	GLN
3	A1	228	GLN
2	P2	158	HIS
2	P3	118	ASN
3	A3	145	GLN

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 [i](#)

There are no oligosaccharides 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.