W O R L D W I D E

wwPDB

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

wwPDB X-ray Structure Validation Summary Report (i)

Jun 19, 2024 – 04:06 AM EDT

PDB ID	:	4AU3
Title	:	Crystal Structure of a Hsp47-collagen complex
Authors	:	Widmer, C.; Gebauer, J.M.; Brunstein, E.; Rodenbaum, S.; Zaucke, F.; Drogemuller, C.; Leeb, T.; Baumann, U.
Deposited on	:	2012-05-14
Resolution	:	2.78 Å(reported)

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

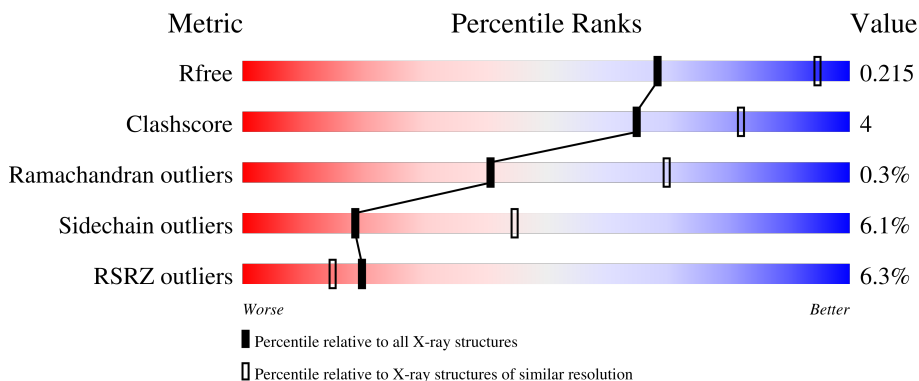|		
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.20.1
EDS	:	2.37.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 2.78 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	Percentile Ranks	Value
Rfree		0.215
Clashscore		4
Ramachandran outliers		0.3%
Sidechain outliers		6.1%
RSRZ outliers		6.3%

Worse ... *Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	4107 (2.80-2.76)
Clashscore	141614	4575 (2.80-2.76)
Ramachandran outliers	138981	4487 (2.80-2.76)
Sidechain outliers	138945	4489 (2.80-2.76)
RSRZ outliers	127900	4027 (2.80-2.76)

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% 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	392	84% 9% • 6%
1	C	392	14% 79% 15% • 6%
1	D	392	3% 81% 11% • 5%
2	B	392	6% 78% 12% • 7%
3	E	20	70% 5% 25%

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Mol	Chain	Length	Quality of chain
3	F	20	80% 20%
3	G	20	70% 5% 25%
3	H	20	80% 5% 15%
3	I	20	70% 10% 20%
3	J	20	65% 10% 25%

2 Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 12171 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 SERPIN PEPTIDASE INHIBITOR, CLADE H (HEAT SHOCK PROTEIN 47), MEMBER 1, (COLLAGEN BINDING PROTEIN 1).

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	367	Total	C	N	O	S	Se	0	0	0
			2886	1839	501	532	1	13			
1	C	370	Total	C	N	O	S	Se	0	0	0
			2911	1854	505	538	1	13			
1	D	372	Total	C	N	O	S	Se	0	0	0
			2926	1861	513	538	1	13			

There are 27 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	35	MSE	-	expression tag	UNP E2RHY7
A	419	LEU	-	expression tag	UNP E2RHY7
A	420	GLU	-	expression tag	UNP E2RHY7
A	421	HIS	-	expression tag	UNP E2RHY7
A	422	HIS	-	expression tag	UNP E2RHY7
A	423	HIS	-	expression tag	UNP E2RHY7
A	424	HIS	-	expression tag	UNP E2RHY7
A	425	HIS	-	expression tag	UNP E2RHY7
A	426	HIS	-	expression tag	UNP E2RHY7
C	35	MSE	-	expression tag	UNP E2RHY7
C	419	LEU	-	expression tag	UNP E2RHY7
C	420	GLU	-	expression tag	UNP E2RHY7
C	421	HIS	-	expression tag	UNP E2RHY7
C	422	HIS	-	expression tag	UNP E2RHY7
C	423	HIS	-	expression tag	UNP E2RHY7
C	424	HIS	-	expression tag	UNP E2RHY7
C	425	HIS	-	expression tag	UNP E2RHY7
C	426	HIS	-	expression tag	UNP E2RHY7
D	35	MSE	-	expression tag	UNP E2RHY7
D	419	LEU	-	expression tag	UNP E2RHY7
D	420	GLU	-	expression tag	UNP E2RHY7
D	421	HIS	-	expression tag	UNP E2RHY7

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Chain	Residue	Modelled	Actual	Comment	Reference
D	422	HIS	-	expression tag	UNP E2RHY7
D	423	HIS	-	expression tag	UNP E2RHY7
D	424	HIS	-	expression tag	UNP E2RHY7
D	425	HIS	-	expression tag	UNP E2RHY7
D	426	HIS	-	expression tag	UNP E2RHY7

- Molecule 2 is a protein called SERPYIN PEPTIDASE INHIBITOR, CLADE H (HEAT SHOCK PROTEIN 47), MEMBER 1, (COLLAGEN BINDING PROTEIN 1).

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	364	Total 2856	C 1817	N 498	O 527	S 1	Se 13	0	0	0

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	35	MSE	-	expression tag	UNP E2RHY7
B	419	LEU	-	expression tag	UNP E2RHY7
B	420	GLU	-	expression tag	UNP E2RHY7
B	421	HIS	-	expression tag	UNP E2RHY7
B	422	HIS	-	expression tag	UNP E2RHY7
B	423	HIS	-	expression tag	UNP E2RHY7
B	424	HIS	-	expression tag	UNP E2RHY7
B	425	HIS	-	expression tag	UNP E2RHY7
B	426	HIS	-	expression tag	UNP E2RHY7

- Molecule 3 is a protein called 18ER COLLAGEN MODEL PEPTIDE 15-R8.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	E	15	Total 94	C 61	N 18	O 15	0	0	0
3	F	16	Total 101	C 66	N 19	O 16	0	0	0
3	G	15	Total 94	C 61	N 18	O 15	0	0	0
3	H	17	Total 108	C 71	N 20	O 17	0	0	0
3	I	16	Total 101	C 66	N 19	O 16	0	0	0
3	J	15	Total 94	C 61	N 18	O 15	0	0	0

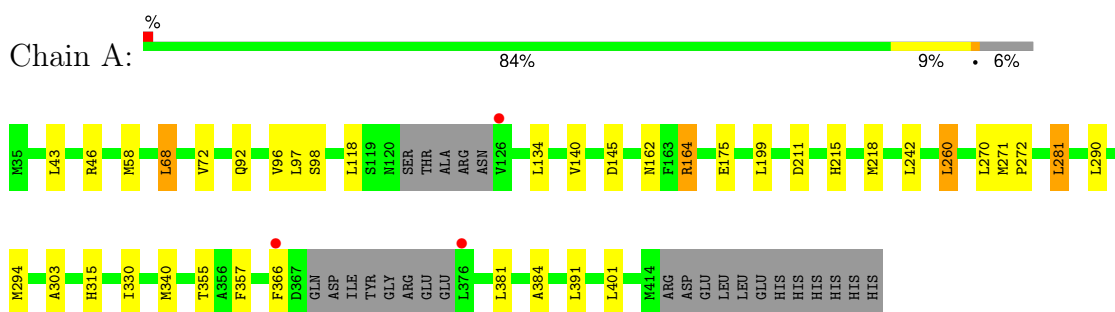There are 12 discrepancies between the modelled and reference sequences:

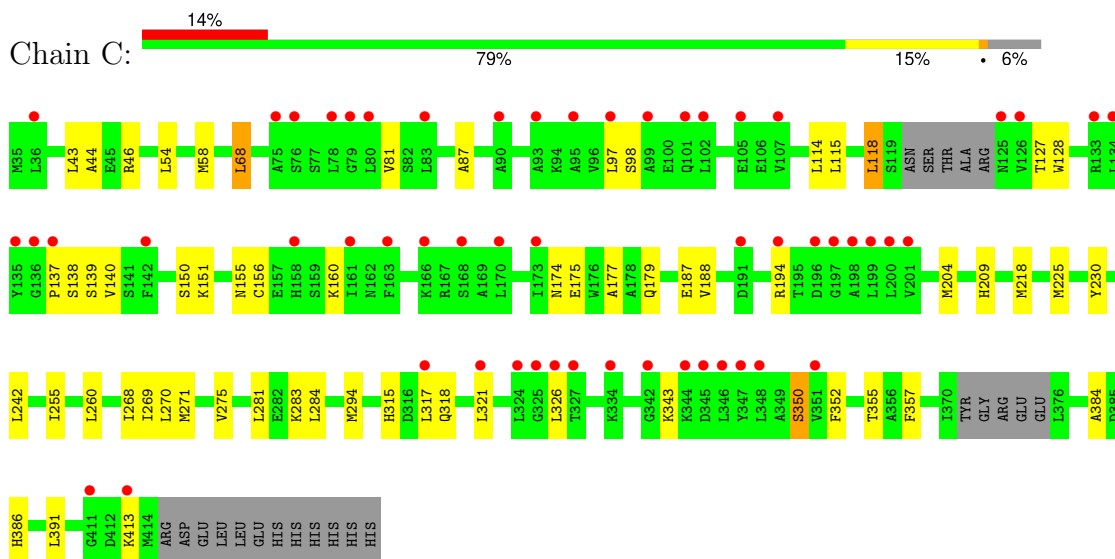| Chain	Residue	Modelled	Actual	Comment	Reference
E	0	ACE	-	expression tag	UNP Q96A83
E	19	NH2	-	expression tag	UNP Q96A83
F	0	ACE	-	expression tag	UNP Q96A83
F	19	NH2	-	expression tag	UNP Q96A83
G	0	ACE	-	expression tag	UNP Q96A83
G	19	NH2	-	expression tag	UNP Q96A83
H	0	ACE	-	expression tag	UNP Q96A83
H	19	NH2	-	expression tag	UNP Q96A83
I	0	ACE	-	expression tag	UNP Q96A83
I	19	NH2	-	expression tag	UNP Q96A83
J	0	ACE	-	expression tag	UNP Q96A83
J	19	NH2	-	expression tag	UNP Q96A83

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 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.
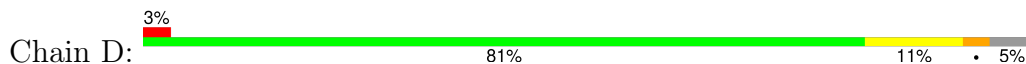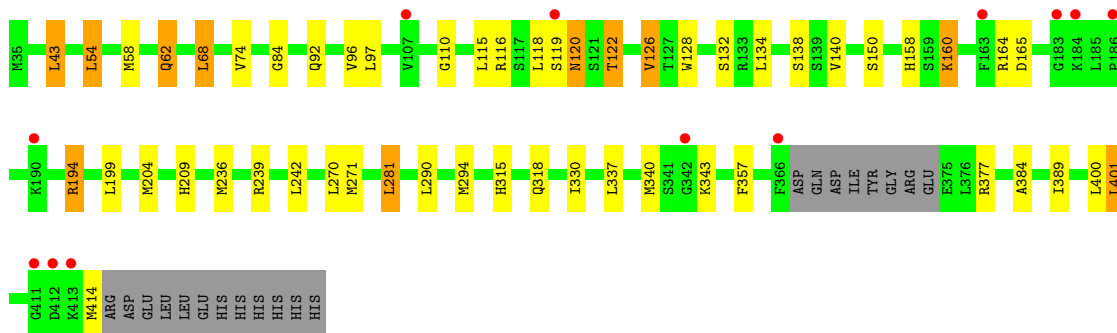
• Molecule 1: SERPIN PEPTIDASE INHIBITOR, CLADE H (HEAT SHOCK PROTEIN 47), MEMBER 1, (COLLAGEN BINDING PROTEIN 1)

• Molecule 1: SERPIN PEPTIDASE INHIBITOR, CLADE H (HEAT SHOCK PROTEIN 47), MEMBER 1, (COLLAGEN BINDING PROTEIN 1)
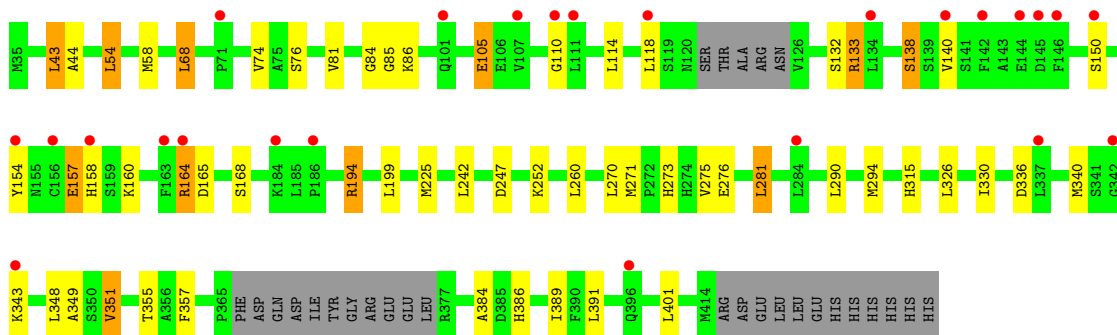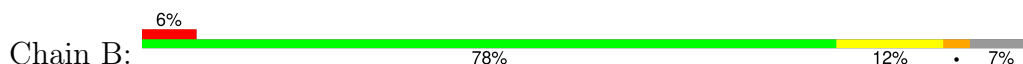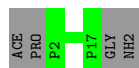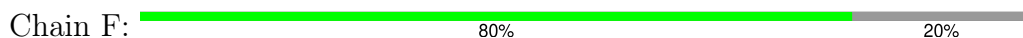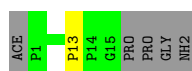

• Molecule 1: SERPIN PEPTIDASE INHIBITOR, CLADE H (HEAT SHOCK PROTEIN 47), MEMBER 1, (COLLAGEN BINDING PROTEIN 1)

M35 L43 L54 M58 Q62 L68 V74 G84 Q92 V96 L97 V107 G110 L115 R116 S117 L118 S119 N120 S121 T122 V126 T127 W128 S132 R133 L134 S138 S139 V140 S150 H158 S159 K160 F163 R164 D165 G183 K184 L185 P186

K190 R194 L199 M204 H209 M236 R239 L242 L270 M271 L281 L290 M294 H315 Q318 I330 L337 M340 S341 G342 K343 F357 F366 ASP GLN ASP ILE TYR GLY ARG GLU E375 L376 R377 A384 I389 L400 L401

G411 D412 K413 M414 ARG ASP GLU LEU LEU GLU HIS HIS HIS HIS HIS HIS

• **Molecule 2: SERPYIN PEPTIDASE INHIBITOR, CLADE H (HEAT SHOCK PROTEIN 47), MEMBER 1, (COLLAGEN BINDING PROTEIN 1)**

Chain B:

M35 L43 A44 L54 M58 L68 P71 V74 A75 S76 V81 G84 G85 K86 Q101 E105 E106 V107 G110 L111 L114 L118 S119 N120 SER THR ALA ARG ASN V126 S132 R133 L134 S138 S139 V140 S141 F142 A143 E144 D145 F146 S150

Y154 N155 C156 E157 H158 S159 K160 F163 R164 D165 S168 K184 L185 P186 R194 L199 M225 I242 D247 K252 I260 L270 M271 P272 H273 H274 V275 E276 L281 L284 L290 M294 H315 L326 I330 D336 L337 M340 S341 G342

K343 L348 A349 S350 V351 T355 A356 F357 P365 PHE ASP GLN ASP ILE TYR GLY ARG GLU GLU LEU R377 A384 D385 H386 I389 F390 L391 Q396 L401 M414 ARG ASP GLU LEU LEU GLU HIS HIS HIS HIS HIS HIS

• **Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8**

Chain E:

ACE PRO P2 P14 G15 P16 PRO GLY NH2

• **Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8**

Chain F:

ACE PRO P2 P17 GLY NH2

• **Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8**

Chain G:

ACE P1 P13 P14 G15 PRO PRO GLY NH2

• **Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8**

Chain H:

ACE P1 P8 P17 GLY NH2

• Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8

Chain I:

70%　　　　10%　　　　20%

ACE P1 P7 P16 PRO GLY NH2

• Molecule 3: 18ER COLLAGEN MODEL PEPTIDE 15-R8

Chain J:

65%　　　　10%　　　　25%

ACE P1 P2 G15 PRO PRO GLY NH2

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 41 2 2	Depositor
Cell constants a, b, c, α, β, γ	101.26Å 101.26Å 366.98Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	91.74 – 2.78 91.75 – 2.68	Depositor EDS
% Data completeness (in resolution range)	98.7 (91.74-2.78) 97.8 (91.75-2.68)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.31 (at 2.69Å)	Xtriage
Refinement program	BUSTER 2.10.0	Depositor
R, R_{free}	0.203 , 0.234 0.216 , 0.215	Depositor DCC
R_{free} test set	1463 reflections (2.72%)	wwPDB-VP
Wilson B-factor (Å^2)	62.8	Xtriage
Anisotropy	0.131	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 54.6	EDS
L-test for twinning[2]	$< |L| > = 0.47, < L^2 > = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	12171	wwPDB-VP
Average B, all atoms (Å^2)	77.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.18% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

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	0.54	0/2932	0.73	0/3932
1	C	0.50	0/2957	0.72	0/3966
1	D	0.49	0/2973	0.73	1/3988 (0.0%)
2	B	0.49	0/2901	0.73	0/3889
3	E	0.44	0/102	0.43	0/143
3	F	0.45	0/110	0.48	0/155
3	G	0.52	0/102	0.44	0/143
3	H	0.55	0/118	0.44	0/167
3	I	0.44	0/110	0.48	0/155
3	J	0.54	0/102	0.46	0/143
All	All	0.51	0/12407	0.72	1/16681 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	164	ARG	C-N-CA	5.16	134.60	121.70

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	2886	0	2919	15	0
1	C	2911	0	2942	30	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	2926	0	2965	22	0
2	B	2856	0	2883	31	0
3	E	94	0	91	1	0
3	F	101	0	98	0	0
3	G	94	0	93	1	0
3	H	108	0	107	1	0
3	I	101	0	100	2	0
3	J	94	0	93	2	0
All	All	12171	0	12291	99	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 4.

The worst 5 of 99 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:230:TYR:HE1	1:C:413:LYS:HB3	1.47	0.77
1:D:43:LEU:HD23	1:D:110:GLY:HA3	1.68	0.74
1:C:58:MSE:HE1	1:C:315:HIS:HB3	1.70	0.73
1:A:72:VAL:HG21	1:A:118:LEU:HD21	1.71	0.73
1:A:58:MSE:HE1	1:A:315:HIS:HB3	1.76	0.68

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	361/392 (92%)	350 (97%)	10 (3%)	1 (0%)	41	70
1	C	364/392 (93%)	346 (95%)	16 (4%)	2 (0%)	29	58
1	D	368/392 (94%)	349 (95%)	17 (5%)	2 (0%)	29	58

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	B	358/392 (91%)	348 (97%)	10 (3%)	0	100	100
3	E	13/20 (65%)	13 (100%)	0	0	100	100
3	F	14/20 (70%)	14 (100%)	0	0	100	100
3	G	13/20 (65%)	13 (100%)	0	0	100	100
3	H	15/20 (75%)	15 (100%)	0	0	100	100
3	I	14/20 (70%)	14 (100%)	0	0	100	100
3	J	13/20 (65%)	13 (100%)	0	0	100	100
All	All	1533/1688 (91%)	1475 (96%)	53 (4%)	5 (0%)	41	70

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	165	ASP
1	A	366	PHE
1	C	138	SER
1	C	87	ALA
1	D	377	ARG

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	313/324 (97%)	298 (95%)	15 (5%)	25	55
1	C	316/324 (98%)	299 (95%)	17 (5%)	22	50
1	D	317/324 (98%)	292 (92%)	25 (8%)	12	31
2	B	309/325 (95%)	285 (92%)	24 (8%)	12	32
3	E	10/12 (83%)	10 (100%)	0	100	100
3	F	11/12 (92%)	11 (100%)	0	100	100
3	G	10/12 (83%)	10 (100%)	0	100	100
3	H	12/12 (100%)	12 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
3	I	11/12 (92%)	11 (100%)	0	100	100
3	J	10/12 (83%)	10 (100%)	0	100	100
All	All	1319/1369 (96%)	1238 (94%)	81 (6%)	18	45

5 of 81 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	54	LEU
1	D	239	ARG
1	D	68	LEU
1	D	134	LEU
1	D	318	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	174	ASN
1	D	62	GLN
1	D	262	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 ⓘ

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 ⓘ

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, 95th 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(Å²)	Q<0.9
1	A	354/392 (90%)	0.04	3 (0%)	86	84	35, 55, 89, 130	0
1	C	357/392 (91%)	0.66	55 (15%)	2	1	33, 82, 153, 179	0
1	D	359/392 (91%)	0.27	12 (3%)	46	41	41, 79, 139, 166	0
2	B	351/392 (89%)	0.48	25 (7%)	16	11	42, 82, 127, 178	0
3	E	15/20 (75%)	0.17	0	100	100	47, 60, 89, 98	0
3	F	16/20 (80%)	0.18	0	100	100	49, 60, 91, 95	0
3	G	15/20 (75%)	0.11	0	100	100	39, 51, 86, 97	0
3	H	17/20 (85%)	-0.08	0	100	100	37, 46, 75, 83	0
3	I	16/20 (80%)	-0.03	0	100	100	40, 51, 86, 94	0
3	J	15/20 (75%)	0.00	0	100	100	33, 48, 78, 98	0
All	All	1515/1688 (89%)	0.34	95 (6%)	20	15	33, 70, 138, 179	0

The worst 5 of 95 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	413	LYS	8.8
2	B	342	GLY	8.0
1	A	366	PHE	7.6
2	B	343	LYS	6.6
1	C	348	LEU	6.1

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

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

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.