



wwPDB X-ray Structure Validation Summary Report ⓘ

Dec 16, 2023 – 09:20 PM EST

PDB ID : 2NN6
Title : Structure of the human RNA exosome composed of Rrp41, Rrp45, Rrp46, Rrp43, Mtr3, Rrp42, Csl4, Rrp4, and Rrp40
Authors : Lima, C.D.
Deposited on : 2006-10-23
Resolution : 3.35 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

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>.

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 : 2.36
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) : 2.36

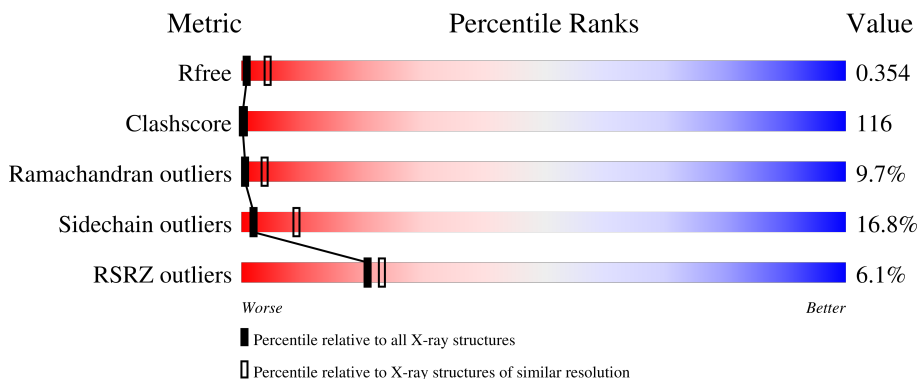
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.35 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.



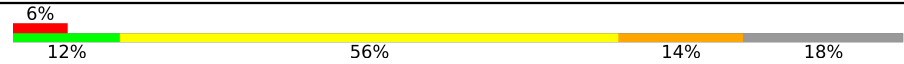

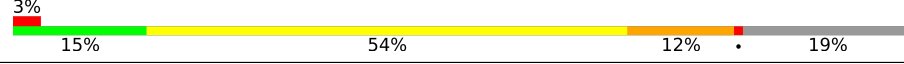

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1558 (3.42-3.30)
Clashscore	141614	1627 (3.42-3.30)
Ramachandran outliers	138981	1599 (3.42-3.30)
Sidechain outliers	138945	1598 (3.42-3.30)
RSRZ outliers	127900	1507 (3.42-3.30)

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 $\leq 5\%$. 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	358	
2	B	249	
3	C	278	
4	D	237	
5	E	305	

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Mol	Chain	Length	Quality of chain
6	F	272	
7	G	289	
8	H	308	
9	I	209	

2 Entry composition

There are 9 unique types of molecules in this entry. The entry contains 16858 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 Polymyositis/scleroderma autoantigen 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	340	2611	1651	464	477	19	0	0	0

There are 17 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-16	MET	-	cloning artifact	UNP Q86Y41
A	-15	GLY	-	cloning artifact	UNP Q86Y41
A	-14	SER	-	cloning artifact	UNP Q86Y41
A	-13	SER	-	cloning artifact	UNP Q86Y41
A	-12	HIS	-	cloning artifact	UNP Q86Y41
A	-11	HIS	-	cloning artifact	UNP Q86Y41
A	-10	HIS	-	cloning artifact	UNP Q86Y41
A	-9	HIS	-	cloning artifact	UNP Q86Y41
A	-8	HIS	-	cloning artifact	UNP Q86Y41
A	-7	HIS	-	cloning artifact	UNP Q86Y41
A	-6	SER	-	cloning artifact	UNP Q86Y41
A	-5	GLN	-	cloning artifact	UNP Q86Y41
A	-4	ASP	-	cloning artifact	UNP Q86Y41
A	-3	PRO	-	cloning artifact	UNP Q86Y41
A	-2	ASN	-	cloning artifact	UNP Q86Y41
A	-1	SER	-	cloning artifact	UNP Q86Y41
A	0	HIS	-	cloning artifact	UNP Q86Y41

- Molecule 2 is a protein called Exosome complex exonuclease RRP41.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	235	1779	1095	339	336	9	0	0	0

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-4	MET	-	cloning artifact	UNP Q9NPD3
B	-3	ALA	-	cloning artifact	UNP Q9NPD3
B	-2	ASP	-	cloning artifact	UNP Q9NPD3
B	-1	PRO	-	cloning artifact	UNP Q9NPD3
B	0	MET	-	cloning artifact	UNP Q9NPD3

- Molecule 3 is a protein called Exosome complex exonuclease RRP43.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	270	2058	1298	344	402	14	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	-1	ASP	-	cloning artifact	UNP Q96B26
C	0	PRO	-	cloning artifact	UNP Q96B26

- Molecule 4 is a protein called Exosome complex exonuclease RRP46.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	D	205	1534	956	275	291	12	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	-1	SER	-	cloning artifact	UNP Q9NQT4
D	0	LEU	-	cloning artifact	UNP Q9NQT4

- Molecule 5 is a protein called Exosome complex exonuclease RRP42.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
5	E	275	2109	1320	361	413	15	0	0	0

There are 15 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	-13	MET	-	cloning artifact	UNP Q15024
E	-12	GLY	-	cloning artifact	UNP Q15024
E	-11	SER	-	cloning artifact	UNP Q15024

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Chain	Residue	Modelled	Actual	Comment	Reference
E	-10	SER	-	cloning artifact	UNP Q15024
E	-9	HIS	-	cloning artifact	UNP Q15024
E	-8	HIS	-	cloning artifact	UNP Q15024
E	-7	HIS	-	cloning artifact	UNP Q15024
E	-6	HIS	-	cloning artifact	UNP Q15024
E	-5	HIS	-	cloning artifact	UNP Q15024
E	-4	HIS	-	cloning artifact	UNP Q15024
E	-3	SER	-	cloning artifact	UNP Q15024
E	-2	GLN	-	cloning artifact	UNP Q15024
E	-1	ASP	-	cloning artifact	UNP Q15024
E	0	PRO	-	cloning artifact	UNP Q15024
E	274	VAL	LEU	variant	UNP Q15024

- Molecule 6 is a protein called Exosome component 6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
6	F	223	1635	1019	311	298	7	0	0	0

- Molecule 7 is a protein called Exosome complex exonuclease RRP40.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
7	G	236	1793	1128	318	337	10	0	0	0

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
G	-14	MET	-	cloning artifact	UNP Q9NQT5
G	-13	GLY	-	cloning artifact	UNP Q9NQT5
G	-12	SER	-	cloning artifact	UNP Q9NQT5
G	-11	SER	-	cloning artifact	UNP Q9NQT5
G	-10	HIS	-	cloning artifact	UNP Q9NQT5
G	-9	HIS	-	cloning artifact	UNP Q9NQT5
G	-8	HIS	-	cloning artifact	UNP Q9NQT5
G	-7	HIS	-	cloning artifact	UNP Q9NQT5
G	-6	HIS	-	cloning artifact	UNP Q9NQT5
G	-5	HIS	-	cloning artifact	UNP Q9NQT5
G	-4	SER	-	cloning artifact	UNP Q9NQT5
G	-3	GLN	-	cloning artifact	UNP Q9NQT5
G	-2	ASP	-	cloning artifact	UNP Q9NQT5
G	-1	PRO	-	cloning artifact	UNP Q9NQT5

- Molecule 8 is a protein called Exosome complex exonuclease RRP4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
8	H	250	1956	1238	341	365	12	0	0	0

There are 15 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
H	-14	MET	-	cloning artifact	UNP Q13868
H	-13	GLY	-	cloning artifact	UNP Q13868
H	-12	SER	-	cloning artifact	UNP Q13868
H	-11	SER	-	cloning artifact	UNP Q13868
H	-10	HIS	-	cloning artifact	UNP Q13868
H	-9	HIS	-	cloning artifact	UNP Q13868
H	-8	HIS	-	cloning artifact	UNP Q13868
H	-7	HIS	-	cloning artifact	UNP Q13868
H	-6	HIS	-	cloning artifact	UNP Q13868
H	-5	HIS	-	cloning artifact	UNP Q13868
H	-4	SER	-	cloning artifact	UNP Q13868
H	-3	GLN	-	cloning artifact	UNP Q13868
H	-2	ASP	-	cloning artifact	UNP Q13868
H	-1	PRO	-	cloning artifact	UNP Q13868
H	0	HIS	-	cloning artifact	UNP Q13868

- Molecule 9 is a protein called 3'-5' exoribonuclease CSL4 homolog.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
9	I	180	1383	870	241	262	10	0	0	0

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
I	-13	MET	-	cloning artifact	UNP Q9Y3B2
I	-12	GLY	-	cloning artifact	UNP Q9Y3B2
I	-11	SER	-	cloning artifact	UNP Q9Y3B2
I	-10	SER	-	cloning artifact	UNP Q9Y3B2
I	-9	HIS	-	cloning artifact	UNP Q9Y3B2
I	-8	HIS	-	cloning artifact	UNP Q9Y3B2
I	-7	HIS	-	cloning artifact	UNP Q9Y3B2
I	-6	HIS	-	cloning artifact	UNP Q9Y3B2
I	-5	HIS	-	cloning artifact	UNP Q9Y3B2
I	-4	HIS	-	cloning artifact	UNP Q9Y3B2

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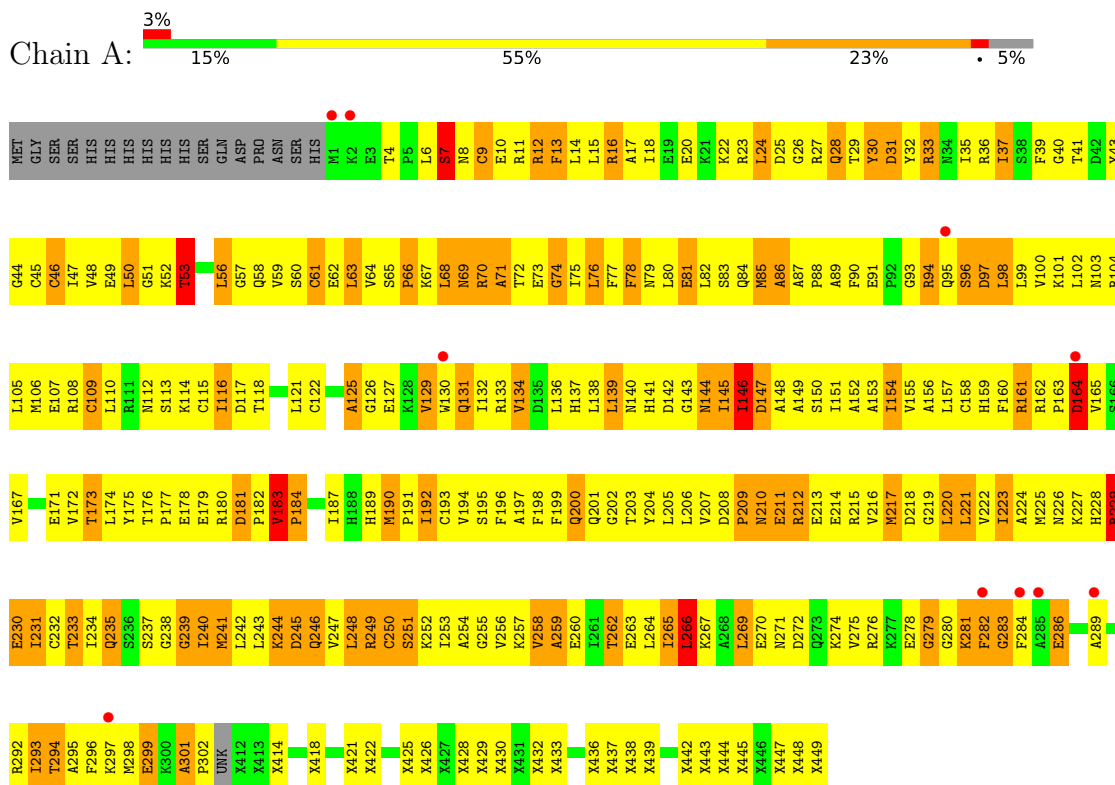
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Chain	Residue	Modelled	Actual	Comment	Reference
I	-3	SER	-	cloning artifact	UNP Q9Y3B2
I	-2	GLN	-	cloning artifact	UNP Q9Y3B2
I	-1	ASP	-	cloning artifact	UNP Q9Y3B2
I	0	PRO	-	cloning artifact	UNP Q9Y3B2

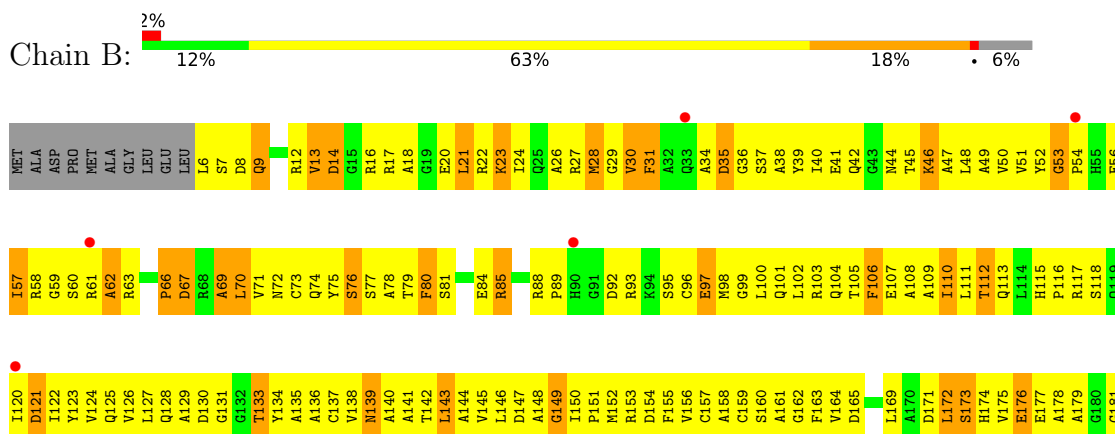
3 Residue-property plots

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: Polymyositis/scleroderma autoantigen 1



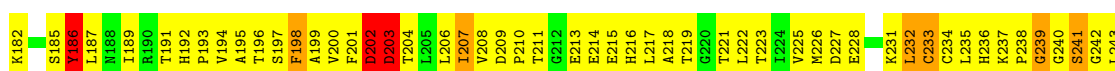
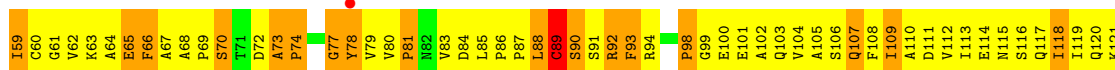
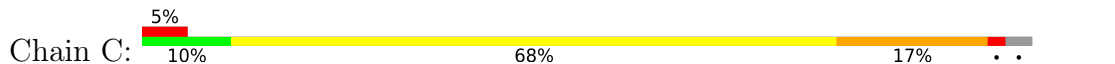
- Molecule 2: Exosome complex exonuclease RRP41



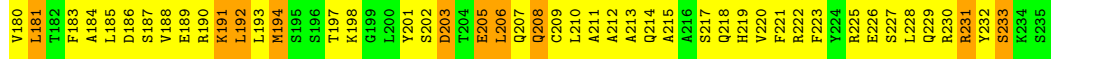
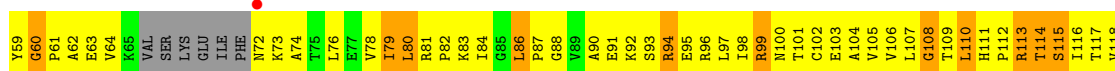


LEU
GLY
ASP

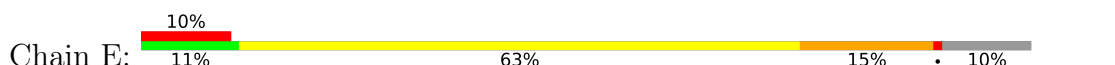
• Molecule 3: Exosome complex exonuclease RRP43

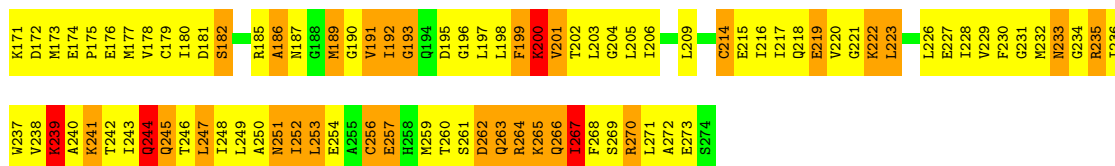


• Molecule 4: Exosome complex exonuclease RRP46

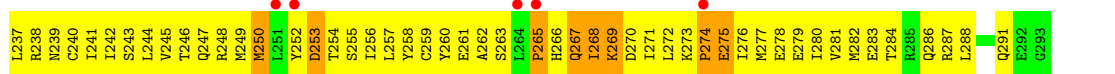
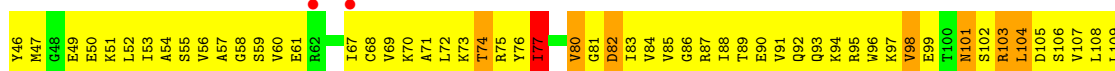
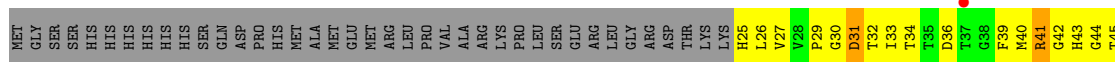
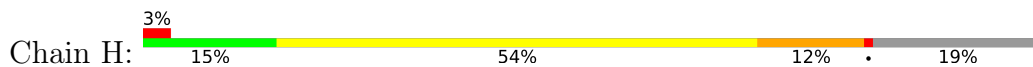


• Molecule 5: Exosome complex exonuclease RRP42

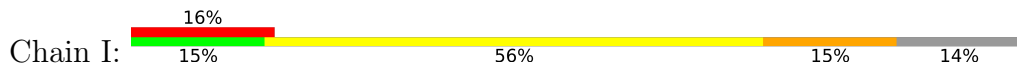




● Molecule 8: Exosome complex exonuclease RRP4



● Molecule 9: 3'-5' exoribonuclease CSL4 homolog



4 Data and refinement statistics

Property	Value	Source
Space group	P 4 3 2	Depositor
Cell constants a, b, c, α , β , γ	307.80Å 307.80Å 307.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	14.98 – 3.35 34.85 – 3.35	Depositor EDS
% Data completeness (in resolution range)	97.7 (14.98-3.35) 97.8 (34.85-3.35)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.47 (at 3.32Å)	Xtrriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.291 , 0.344 0.300 , 0.354	Depositor DCC
R_{free} test set	3514 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	87.8	Xtrriage
Anisotropy	0.000	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.20 , 62.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.33$, $\langle L^2 \rangle = 0.17$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.87	EDS
Total number of atoms	16858	wwPDB-VP
Average B, all atoms (Å ²)	119.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.72% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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	A	0.62	0/2418	0.87	4/3256 (0.1%)
2	B	0.51	0/1804	0.81	2/2439 (0.1%)
3	C	0.46	0/2092	0.73	0/2839
4	D	0.54	0/1552	0.79	1/2097 (0.0%)
5	E	0.41	0/2138	0.72	0/2890
6	F	0.41	0/1658	0.69	0/2247
7	G	0.62	0/1819	0.91	2/2451 (0.1%)
8	H	0.39	0/1985	0.72	0/2679
9	I	0.41	0/1407	0.74	1/1899 (0.1%)
All	All	0.50	0/16873	0.78	10/22797 (0.0%)

There are no bond length outliers.

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	266	LEU	CA-CB-CG	-7.27	98.57	115.30
7	G	253	LEU	CA-CB-CG	-6.87	99.50	115.30
1	A	53	THR	N-CA-C	-6.70	92.92	111.00
1	A	33	ARG	N-CA-C	-5.80	95.33	111.00
7	G	193	GLY	N-CA-C	5.79	127.58	113.10

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	2611	0	2673	640	0
2	B	1779	0	1770	414	0
3	C	2058	0	2084	608	0
4	D	1534	0	1572	415	0
5	E	2109	0	2122	495	0
6	F	1635	0	1686	409	0
7	G	1793	0	1827	495	0
8	H	1956	0	2002	414	0
9	I	1383	0	1405	329	0
All	All	16858	0	17141	3953	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 116.

The worst 5 of 3953 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)
4:D:202:SER:N	4:D:205:GLU:HG3	1.49	1.25
1:A:230:GLU:HB3	2:B:205:HIS:HA	1.22	1.18
8:H:220:ILE:HA	8:H:223:LEU:HD13	1.26	1.18
9:I:24:SER:HB3	9:I:54:SER:HB2	1.24	1.18
3:C:126:ILE:HB	3:C:131:LEU:HB3	1.25	1.17

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	300/358 (84%)	209 (70%)	60 (20%)	31 (10%)	0 3
2	B	233/249 (94%)	156 (67%)	56 (24%)	21 (9%)	1 5
3	C	268/278 (96%)	193 (72%)	44 (16%)	31 (12%)	0 2

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
4	D	201/237 (85%)	157 (78%)	29 (14%)	15 (8%)	1	7
5	E	271/305 (89%)	200 (74%)	47 (17%)	24 (9%)	1	5
6	F	219/272 (80%)	166 (76%)	32 (15%)	21 (10%)	0	4
7	G	232/289 (80%)	152 (66%)	51 (22%)	29 (12%)	0	2
8	H	244/308 (79%)	182 (75%)	41 (17%)	21 (9%)	1	5
9	I	178/209 (85%)	122 (68%)	40 (22%)	16 (9%)	1	5
All	All	2146/2505 (86%)	1537 (72%)	400 (19%)	209 (10%)	0	4

5 of 209 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	7	SER
1	A	68	LEU
1	A	69	ASN
1	A	94	ARG
1	A	227	LYS

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	264/280 (94%)	196 (74%)	68 (26%)	0	2
2	B	179/189 (95%)	146 (82%)	33 (18%)	1	6
3	C	232/237 (98%)	201 (87%)	31 (13%)	4	16
4	D	168/195 (86%)	144 (86%)	24 (14%)	3	14
5	E	240/265 (91%)	205 (85%)	35 (15%)	3	13
6	F	157/188 (84%)	135 (86%)	22 (14%)	3	15
7	G	192/234 (82%)	150 (78%)	42 (22%)	1	3
8	H	219/268 (82%)	194 (89%)	25 (11%)	5	22
9	I	157/183 (86%)	133 (85%)	24 (15%)	2	12
All	All	1808/2039 (89%)	1504 (83%)	304 (17%)	2	9

5 of 304 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
7	G	143	LEU
9	I	80	SER
7	G	201	VAL
8	H	98	VAL
9	I	169	TRP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 58 such sidechains are listed below:

Mol	Chain	Res	Type
4	D	218	GLN
9	I	139	GLN
6	F	221	GLN
9	I	97	ASN
8	H	199	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 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

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, 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(Å ²)	Q < 0.9
1	A	302/358 (84%)	-0.01	10 (3%) 46 48	15, 86, 175, 194	0
2	B	235/249 (94%)	0.08	5 (2%) 63 67	21, 99, 145, 181	0
3	C	270/278 (97%)	0.13	14 (5%) 27 29	66, 117, 171, 203	0
4	D	205/237 (86%)	0.06	6 (2%) 51 54	38, 94, 128, 157	0
5	E	275/305 (90%)	0.51	31 (11%) 5 6	87, 133, 181, 195	0
6	F	223/272 (81%)	0.08	16 (7%) 15 18	77, 131, 174, 189	0
7	G	236/289 (81%)	-0.08	7 (2%) 50 53	19, 98, 153, 189	0
8	H	250/308 (81%)	0.25	10 (4%) 38 40	94, 146, 185, 204	0
9	I	180/209 (86%)	0.56	33 (18%) 1 1	88, 142, 178, 193	0
All	All	2176/2505 (86%)	0.17	132 (6%) 21 23	15, 118, 176, 204	0

The worst 5 of 132 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
5	E	133	TRP	7.0
5	E	282	PRO	6.7
8	H	265	PRO	6.5
8	H	264	LEU	5.8
9	I	53	VAL	5.6

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

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.