



# wwPDB X-ray Structure Validation Summary Report

Sep 23, 2023 – 10:53 PM EDT

PDB ID : 5TBK  
Title : Crystal structure of human importin  $\alpha 3$  bound to RCC1  
Authors : Sankhala, R.S.; Lokareddy, R.K.; Pumroy, R.A.; Cingolani, G.  
Deposited on : 2016-09-12  
Resolution : 3.45 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)

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 : 2.35.1  
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) : 2.35.1

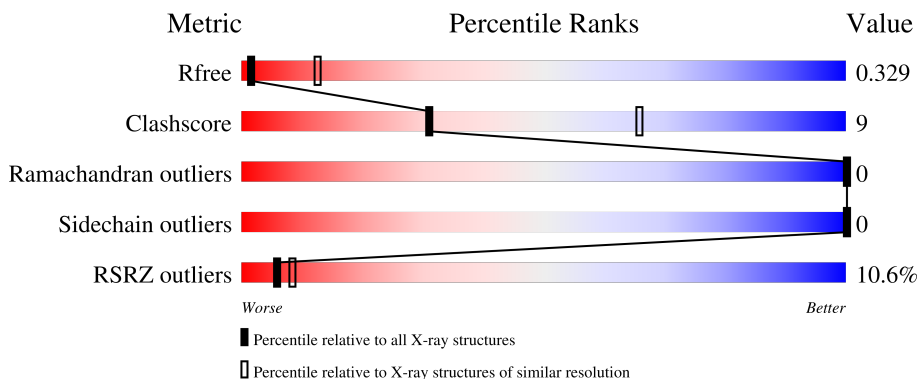
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*






The reported resolution of this entry is 3.45 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	1291 (3.52-3.40)
Clashscore	141614	1372 (3.52-3.40)
Ramachandran outliers	138981	1337 (3.52-3.40)
Sidechain outliers	138945	1338 (3.52-3.40)
RSRZ outliers	127900	1205 (3.52-3.40)

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	521	 2% 64% 16% 20%
1	B	521	 3% 65% 15% 20%
1	C	521	 2% 66% 14% 20%
1	D	521	 5% 63% 17% 20%
1	E	521	 2% 65% 15% 20%

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Mol	Chain	Length	Quality of chain
1	F	521	<p>3% 65% 15% 20%</p>
1	G	521	<p>5% 65% 15% 20%</p>
1	H	521	<p>2% 65% 15% 20%</p>
2	I	421	<p>27% 76% 24%</p>
2	J	421	<p>5% 77% 22%</p>
2	K	421	<p>2% 75% 25%</p>
2	L	421	<p>21% 75% 24%</p>
2	M	421	<p>16% 74% 26%</p>
2	N	421	<p>18% 79% 21%</p>
2	O	421	<p>19% 76% 23%</p>
2	P	421	<p>30% 77% 23%</p>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 50677 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 Importin subunit alpha-3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	417	Total 3219	C 2043	N 545	O 618	S 13	0	0	0
1	B	415	Total 3187	C 2024	N 541	O 609	S 13	0	0	0
1	C	417	Total 3200	C 2031	N 543	O 613	S 13	0	0	0
1	D	415	Total 3206	C 2036	N 543	O 614	S 13	0	0	0
1	E	416	Total 3194	C 2028	N 542	O 611	S 13	0	0	0
1	F	416	Total 3194	C 2028	N 542	O 611	S 13	0	0	0
1	G	417	Total 3200	C 2031	N 543	O 613	S 13	0	0	0
1	H	417	Total 3200	C 2031	N 543	O 613	S 13	0	0	0

- Molecule 2 is a protein called Regulator of chromosome condensation.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	I	419	Total 3139	C 1954	N 562	O 604	S 19	0	0	0
2	K	418	Total 3132	C 1949	N 561	O 603	S 19	0	0	0
2	L	418	Total 3132	C 1949	N 561	O 603	S 19	0	0	0
2	M	419	Total 3139	C 1954	N 562	O 604	S 19	0	0	0
2	N	418	Total 3132	C 1949	N 561	O 603	S 19	0	0	0
2	O	418	Total 3132	C 1949	N 561	O 603	S 19	0	0	0

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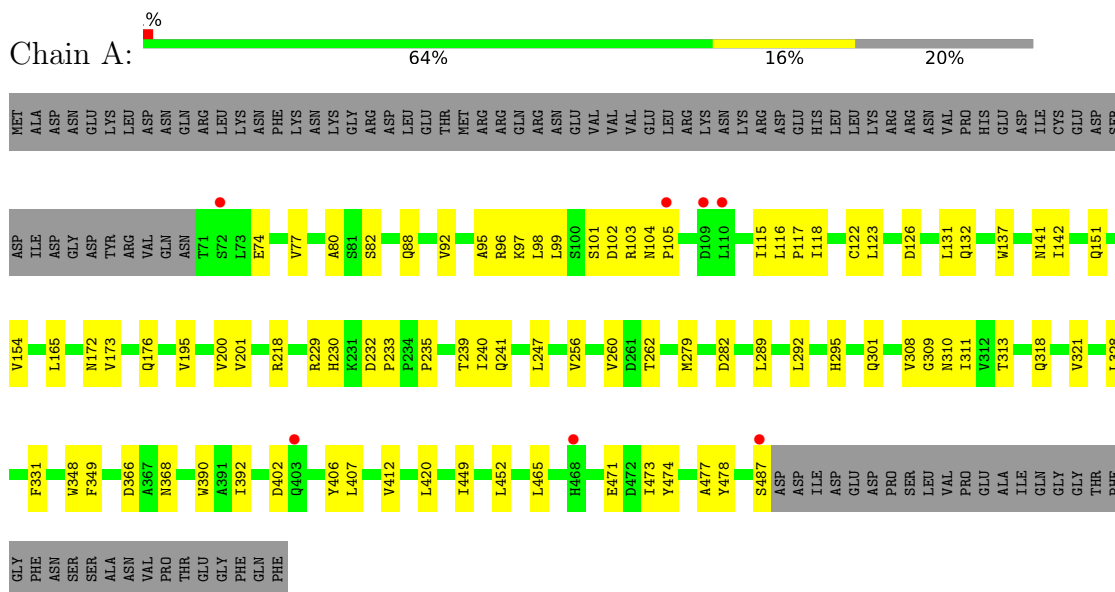
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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	P	419	Total	C	N	O	S	0	0	0
			3139	1954	562	604	19			
2	J	418	Total	C	N	O	S	0	0	0
			3132	1949	561	603	19			

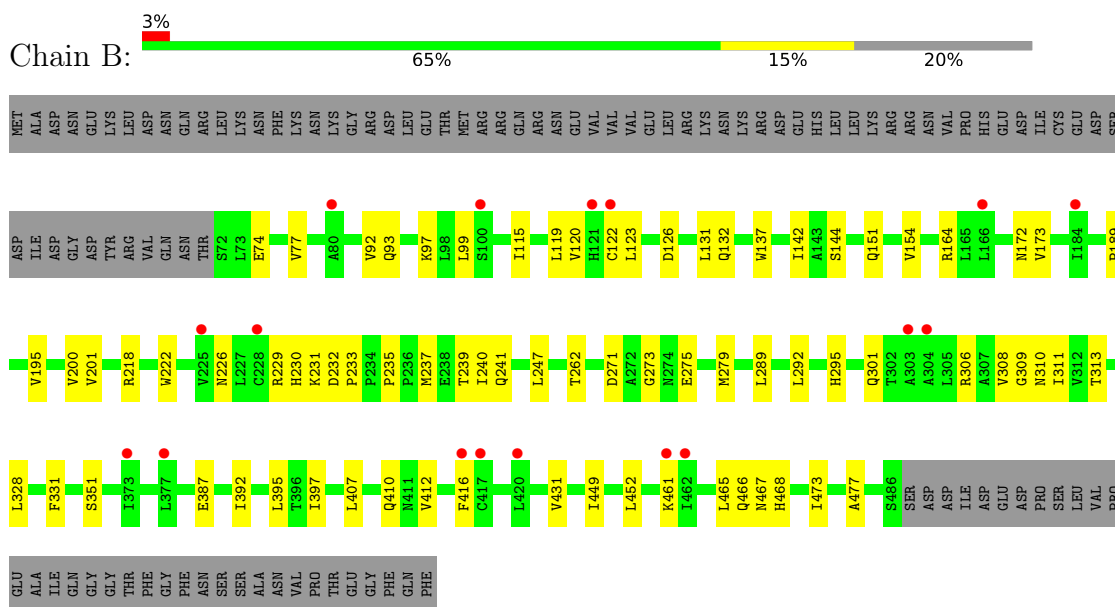
### 3 Residue-property plots

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.

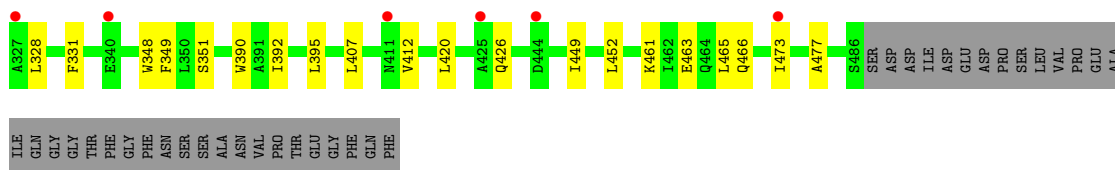
- Molecule 1: Importin subunit alpha-3



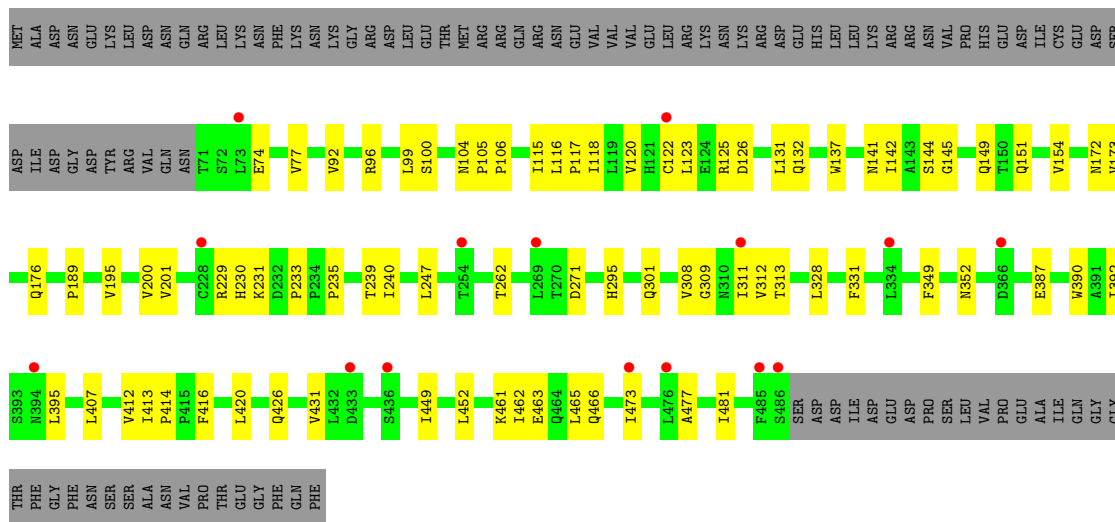
- Molecule 1: Importin subunit alpha-3



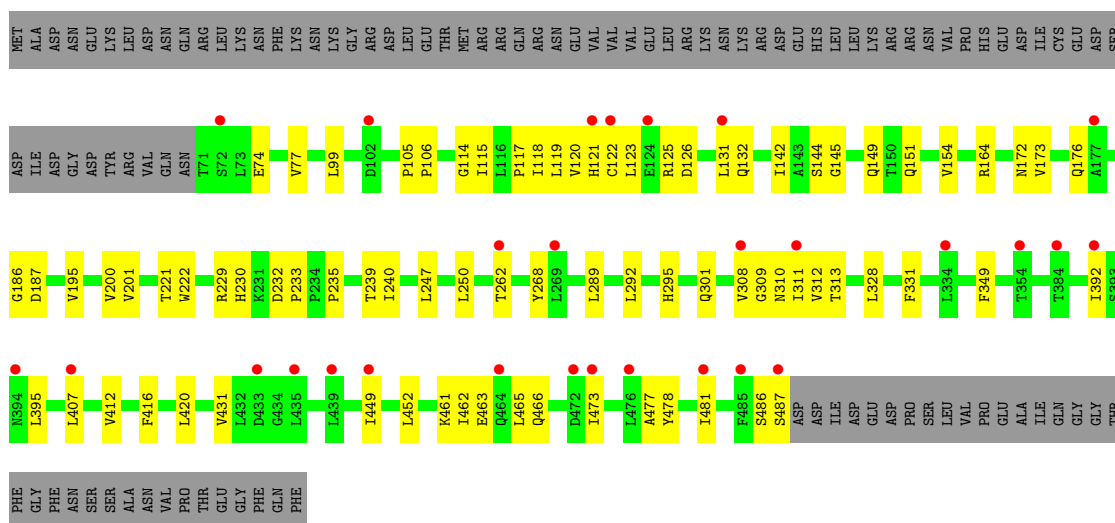




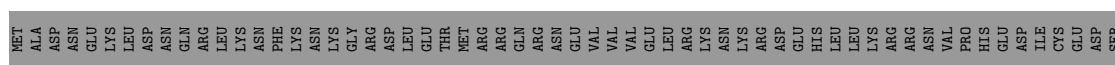
● Molecule 1: Importin subunit alpha-3



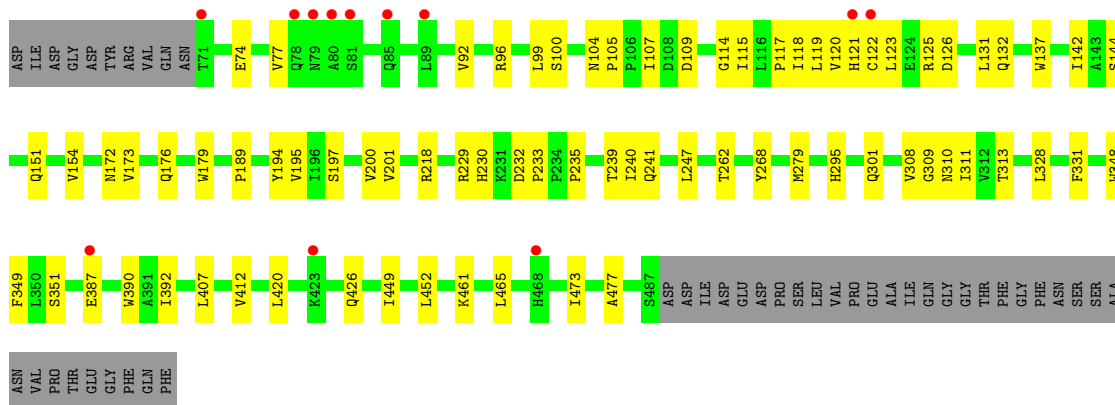
● Molecule 1: Importin subunit alpha-3



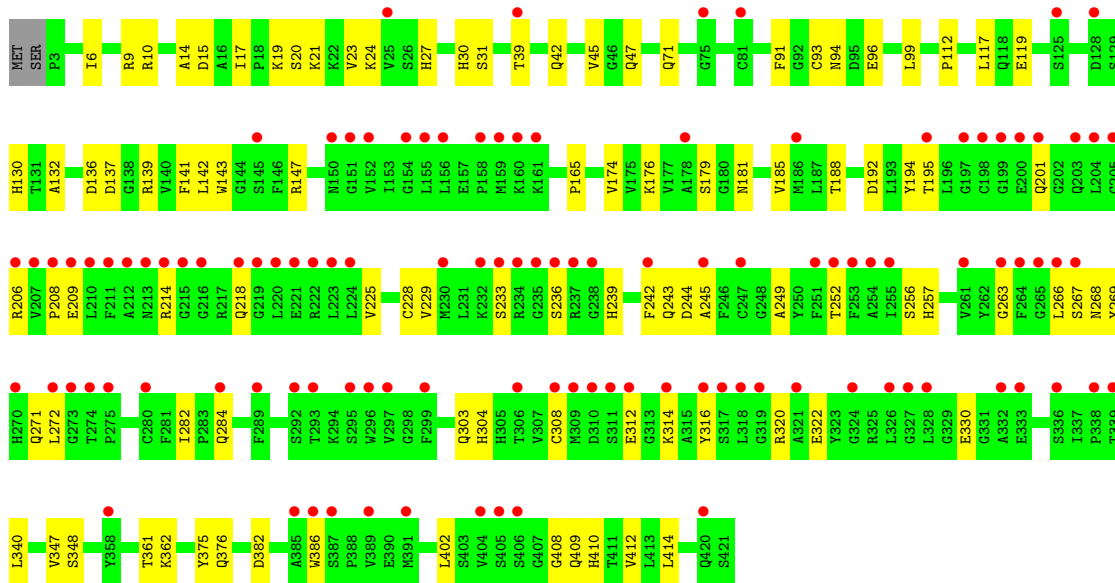
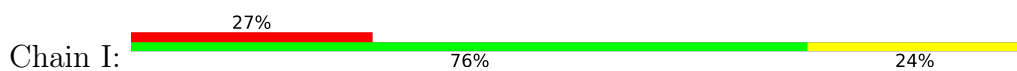
● Molecule 1: Importin subunit alpha-3



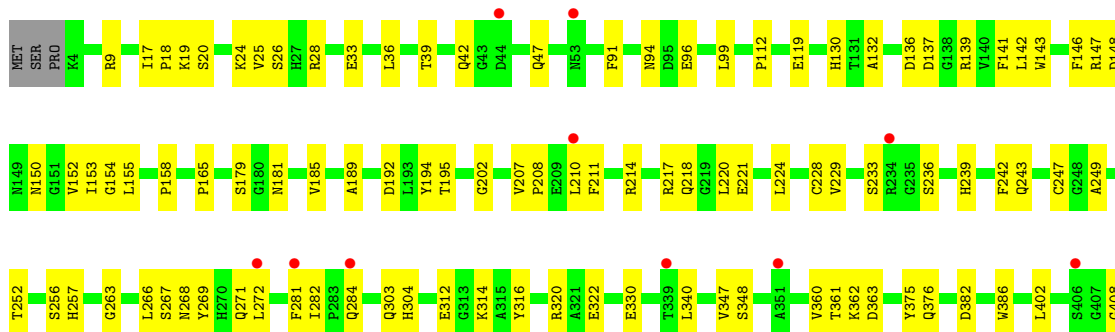
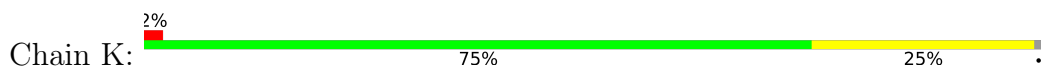




● Molecule 2: Regulator of chromosome condensation

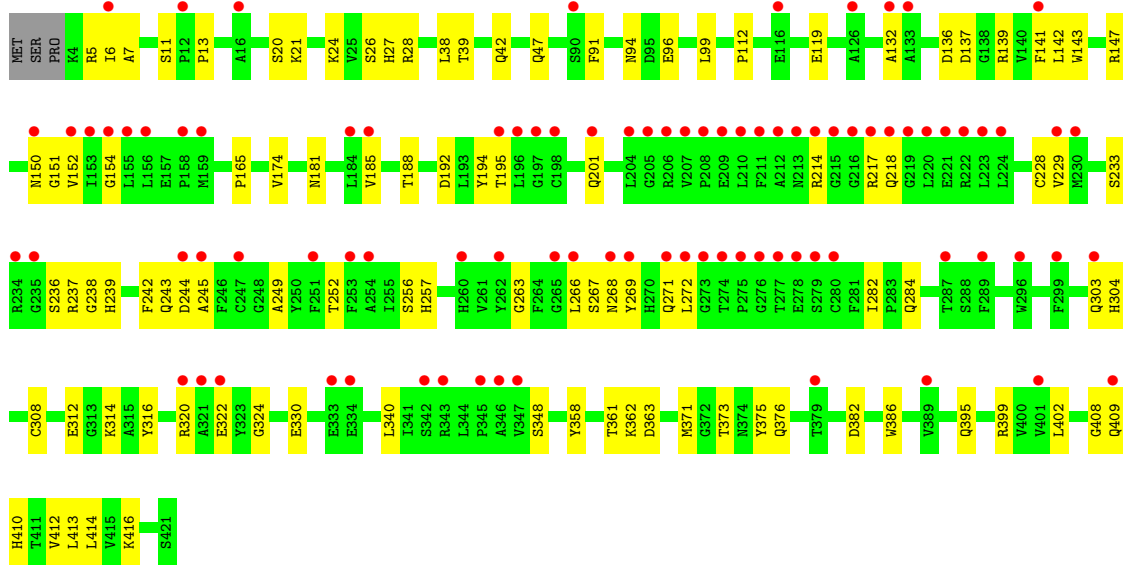
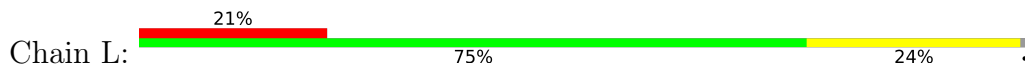


● Molecule 2: Regulator of chromosome condensation

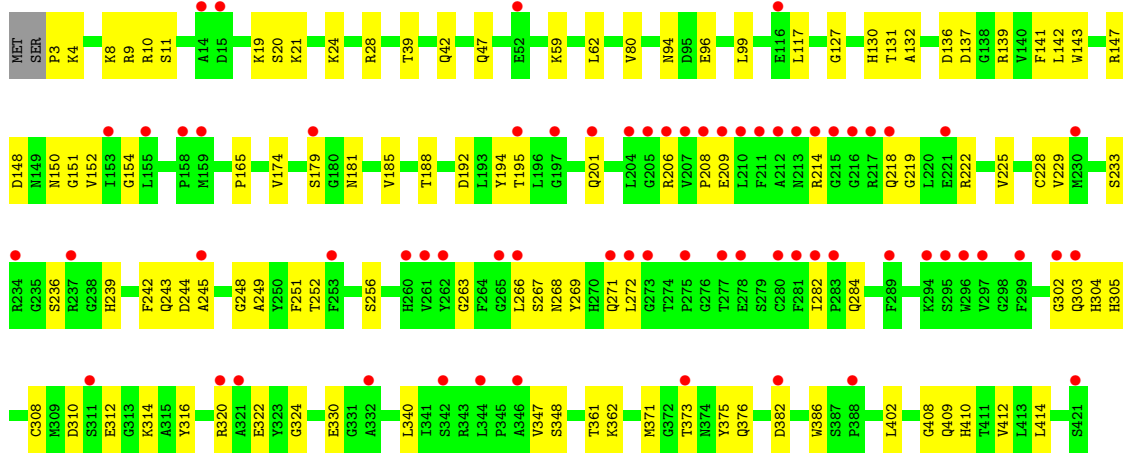
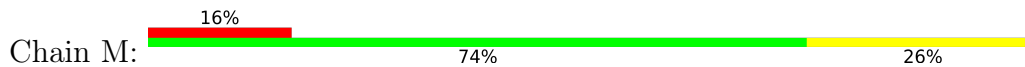




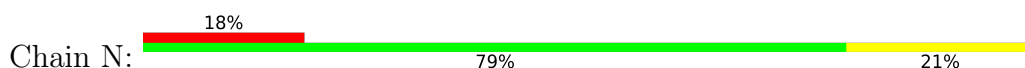
• Molecule 2: Regulator of chromosome condensation

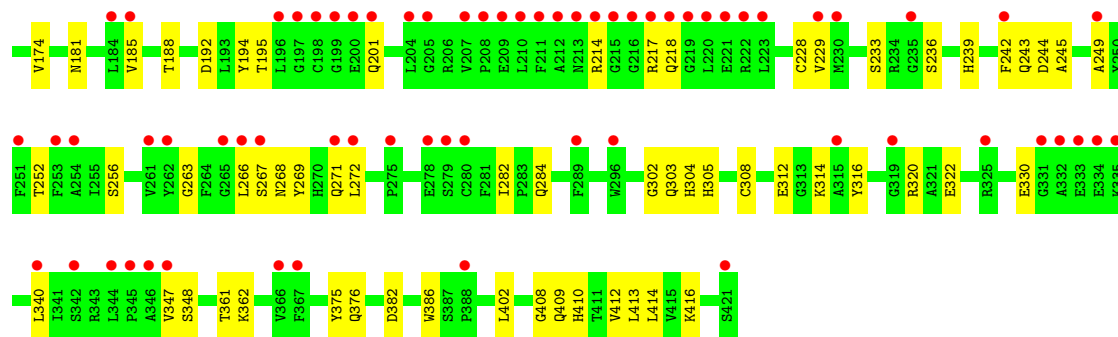


• Molecule 2: Regulator of chromosome condensation

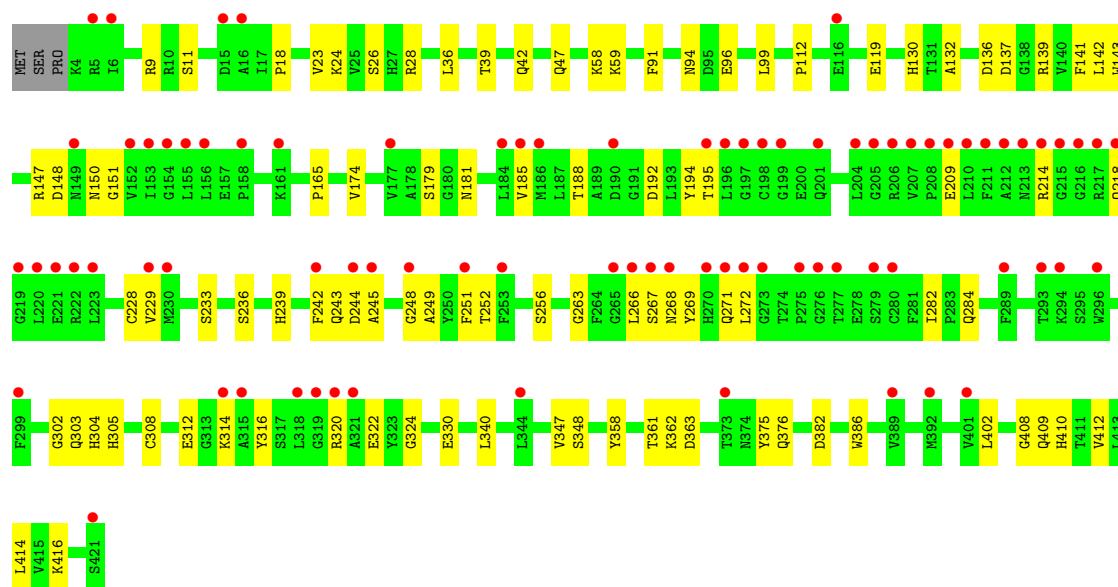
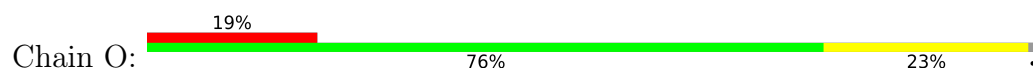


• Molecule 2: Regulator of chromosome condensation

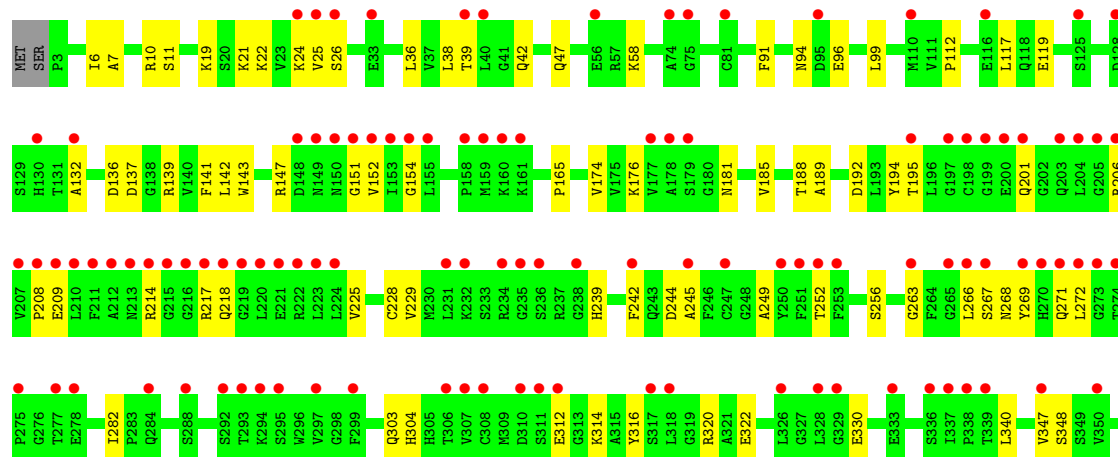
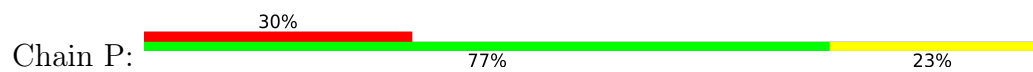


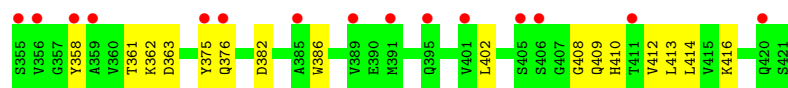


● Molecule 2: Regulator of chromosome condensation

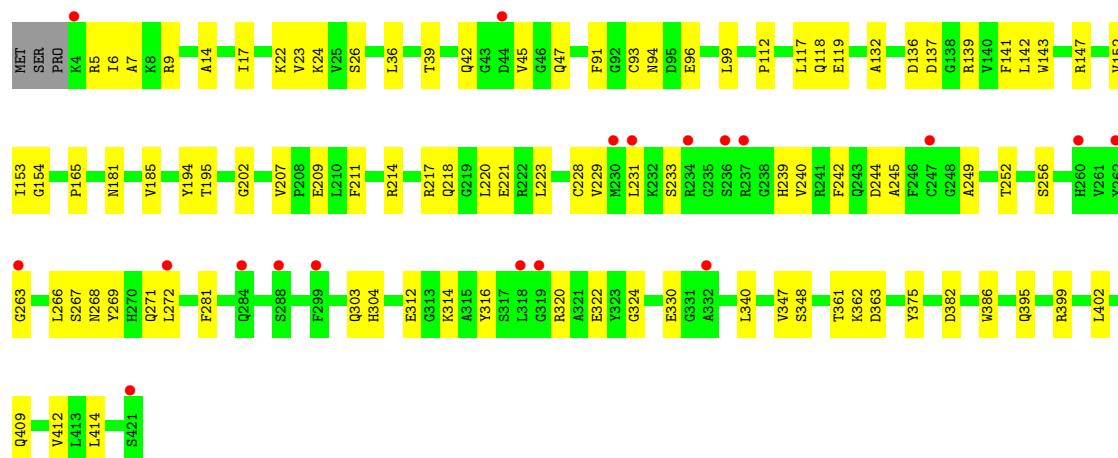
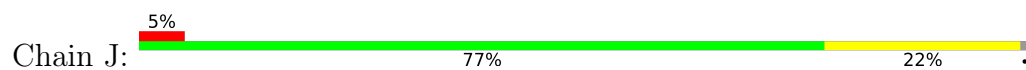


● Molecule 2: Regulator of chromosome condensation





- Molecule 2: Regulator of chromosome condensation



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	127.40Å 162.49Å 161.59Å 75.65° 85.63° 72.17°	Depositor
Resolution (Å)	19.99 – 3.45 49.33 – 3.44	Depositor EDS
% Data completeness (in resolution range)	75.5 (19.99-3.45) 79.7 (49.33-3.44)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.13	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.82 (at 3.40Å)	Xtrriage
Refinement program	PHENIX 1.10.1-2155	Depositor
R, $R_{free}$	0.278 , 0.296 0.309 , 0.329	Depositor DCC
$R_{free}$ test set	2000 reflections (1.39%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	85.6	Xtrriage
Anisotropy	0.255	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.23 , 19.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.45$ , $\langle L^2 \rangle = 0.27$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.87	EDS
Total number of atoms	50677	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	129.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 24.57 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 3.7376e-03.*

<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	A	0.38	0/3279	0.51	0/4481
1	B	0.32	0/3247	0.46	0/4439
1	C	0.36	0/3260	0.50	0/4457
1	D	0.33	0/3266	0.48	0/4463
1	E	0.28	0/3254	0.45	0/4449
1	F	0.31	0/3254	0.46	0/4449
1	G	0.31	0/3260	0.47	0/4457
1	H	0.30	0/3260	0.45	0/4457
2	I	0.27	0/3198	0.49	0/4313
2	J	0.31	0/3190	0.50	0/4302
2	K	0.32	0/3190	0.50	0/4302
2	L	0.27	0/3190	0.48	0/4302
2	M	0.29	0/3198	0.48	0/4313
2	N	0.27	0/3190	0.47	0/4302
2	O	0.28	0/3190	0.49	0/4302
2	P	0.27	0/3198	0.50	0/4313
All	All	0.31	0/51624	0.48	0/70101

There are no bond length outliers.

There are no bond angle outliers.

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	3219	0	3241	80	0
1	B	3187	0	3192	61	0
1	C	3200	0	3204	54	0
1	D	3206	0	3229	77	0
1	E	3194	0	3199	59	0
1	F	3194	0	3199	50	0
1	G	3200	0	3204	55	0
1	H	3200	0	3204	55	0
2	I	3139	0	3110	71	0
2	J	3132	0	3102	72	0
2	K	3132	0	3102	74	0
2	L	3132	0	3102	73	0
2	M	3139	0	3110	66	0
2	N	3132	0	3102	54	0
2	O	3132	0	3102	67	0
2	P	3139	0	3110	79	0
All	All	50677	0	50512	925	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 9.

The worst 5 of 925 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:80:ALA:CA	1:A:88:GLN:HE22	1.36	1.38
1:A:80:ALA:HA	1:A:88:GLN:NE2	1.38	1.32
1:D:95:ALA:O	1:D:98:LEU:HG	1.38	1.20
1:B:226:ASN:OD1	2:I:20:SER:HB2	1.47	1.14
1:D:99:LEU:HD11	2:P:24:LYS:O	1.50	1.11

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	415/521 (80%)	404 (97%)	11 (3%)	0	100	100
1	B	413/521 (79%)	400 (97%)	13 (3%)	0	100	100
1	C	415/521 (80%)	402 (97%)	13 (3%)	0	100	100
1	D	413/521 (79%)	406 (98%)	7 (2%)	0	100	100
1	E	414/521 (80%)	401 (97%)	13 (3%)	0	100	100
1	F	414/521 (80%)	400 (97%)	14 (3%)	0	100	100
1	G	415/521 (80%)	404 (97%)	11 (3%)	0	100	100
1	H	415/521 (80%)	403 (97%)	12 (3%)	0	100	100
2	I	417/421 (99%)	396 (95%)	21 (5%)	0	100	100
2	J	416/421 (99%)	394 (95%)	22 (5%)	0	100	100
2	K	416/421 (99%)	395 (95%)	21 (5%)	0	100	100
2	L	416/421 (99%)	395 (95%)	21 (5%)	0	100	100
2	M	417/421 (99%)	396 (95%)	21 (5%)	0	100	100
2	N	416/421 (99%)	396 (95%)	20 (5%)	0	100	100
2	O	416/421 (99%)	394 (95%)	22 (5%)	0	100	100
2	P	417/421 (99%)	394 (94%)	23 (6%)	0	100	100
All	All	6645/7536 (88%)	6380 (96%)	265 (4%)	0	100	100

There are no Ramachandran outliers to report.

### 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	365/460 (79%)	365 (100%)	0	100	100
1	B	357/460 (78%)	357 (100%)	0	100	100
1	C	359/460 (78%)	359 (100%)	0	100	100
1	D	363/460 (79%)	363 (100%)	0	100	100
1	E	358/460 (78%)	358 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	F	358/460 (78%)	358 (100%)	0	100	100
1	G	359/460 (78%)	359 (100%)	0	100	100
1	H	359/460 (78%)	359 (100%)	0	100	100
2	I	339/341 (99%)	339 (100%)	0	100	100
2	J	338/341 (99%)	338 (100%)	0	100	100
2	K	338/341 (99%)	338 (100%)	0	100	100
2	L	338/341 (99%)	338 (100%)	0	100	100
2	M	339/341 (99%)	339 (100%)	0	100	100
2	N	338/341 (99%)	338 (100%)	0	100	100
2	O	338/341 (99%)	338 (100%)	0	100	100
2	P	339/341 (99%)	339 (100%)	0	100	100
All	All	5585/6408 (87%)	5585 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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	A	417/521 (80%)	0.05	7 (1%) 70 67	23, 67, 143, 273	0
1	B	415/521 (79%)	0.15	17 (4%) 37 36	38, 103, 178, 245	0
1	C	417/521 (80%)	0.08	10 (2%) 59 56	30, 76, 142, 224	0
1	D	415/521 (79%)	0.29	24 (5%) 23 23	52, 105, 196, 263	0
1	E	416/521 (79%)	0.11	12 (2%) 51 49	54, 108, 196, 292	0
1	F	416/521 (79%)	0.05	15 (3%) 42 41	57, 92, 162, 213	0
1	G	417/521 (80%)	0.17	28 (6%) 17 19	64, 103, 170, 241	0
1	H	417/521 (80%)	0.14	12 (2%) 51 49	58, 106, 211, 289	0
2	I	419/421 (99%)	1.56	113 (26%) 0 0	88, 157, 289, 394	0
2	J	418/421 (99%)	0.29	19 (4%) 33 32	61, 102, 169, 241	0
2	K	418/421 (99%)	0.23	10 (2%) 59 56	60, 108, 170, 220	0
2	L	418/421 (99%)	1.09	90 (21%) 0 1	89, 175, 288, 361	0
2	M	419/421 (99%)	0.73	67 (15%) 1 3	63, 129, 277, 346	0
2	N	418/421 (99%)	0.97	75 (17%) 1 2	85, 155, 274, 342	0
2	O	418/421 (99%)	0.92	82 (19%) 1 1	54, 154, 279, 341	0
2	P	419/421 (99%)	1.61	127 (30%) 0 0	90, 169, 296, 368	0
All	All	6677/7536 (88%)	0.53	708 (10%) 6 8	23, 116, 246, 394	0

The worst 5 of 708 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	I	223	LEU	15.2
2	N	272	LEU	15.2
2	P	215	GLY	13.6
2	N	212	ALA	13.3
2	N	266	LEU	12.6

## 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 [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.