



# wwPDB X-ray Structure Validation Summary Report

Feb 18, 2024 – 06:57 AM EST

PDB ID : 4F52  
Title : Structure of a Glomulin-RBX1-CUL1 complex  
Authors : Duda, D.M.; Olszewski, J.L.; Schulman, B.A.  
Deposited on : 2012-05-11  
Resolution : 3.00 Å(reported)

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We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

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<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 : 2.36  
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

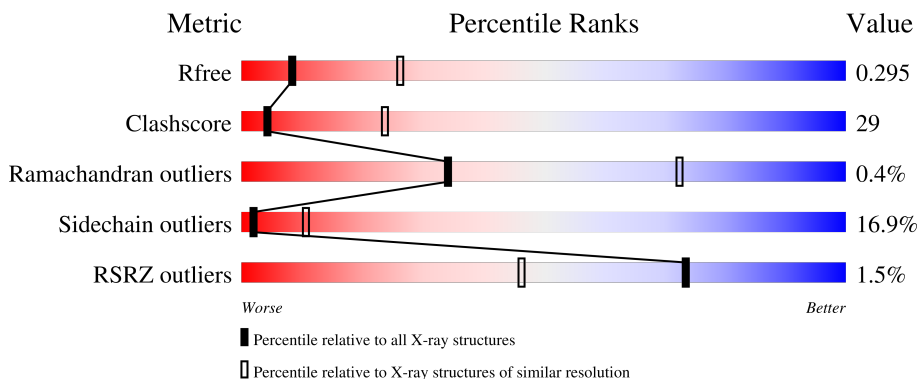
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.00 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	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (3.00-3.00)

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	A	282	<div style="display: flex; align-items: center;"> <div style="width: 2%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 47%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 35%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 9%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 9%; height: 10px; background-color: grey;"></div> </div>
1	C	282	<div style="display: flex; align-items: center;"> <div style="width: 2%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 48%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 35%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 7%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 10%; height: 10px; background-color: grey;"></div> </div>
2	B	106	<div style="display: flex; align-items: center;"> <div style="width: 2%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 36%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 40%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 21%; height: 10px; background-color: grey;"></div> </div>
2	D	106	<div style="display: flex; align-items: center;"> <div style="width: 37%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 33%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 10%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 20%; height: 10px; background-color: grey;"></div> </div>
3	E	596	<div style="display: flex; align-items: center;"> <div style="width: 2%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 40%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 39%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 8%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 12%; height: 10px; background-color: grey;"></div> </div>

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Mol	Chain	Length	Quality of chain
3	F	596	 <p>A horizontal bar chart showing the quality of chain. The bar is divided into four segments: a small red segment at the beginning, a green segment labeled '33%', a yellow segment labeled '44%', and a grey segment at the end labeled '14%'. Above the bar, there is a '%' symbol.</p>

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 13897 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 Cullin-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	258	2103	1341	351	400	11	0	0	0
1	C	254	2073	1326	345	392	10	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	409	GLY	-	expression tag	UNP Q13616
A	410	SER	-	expression tag	UNP Q13616
A	421	GLU	LEU	engineered mutation	UNP Q13616
A	451	GLU	VAL	engineered mutation	UNP Q13616
A	452	LYS	VAL	engineered mutation	UNP Q13616
A	455	LYS	TYR	engineered mutation	UNP Q13616
C	409	GLY	-	expression tag	UNP Q13616
C	410	SER	-	expression tag	UNP Q13616
C	421	GLU	LEU	engineered mutation	UNP Q13616
C	451	GLU	VAL	engineered mutation	UNP Q13616
C	452	LYS	VAL	engineered mutation	UNP Q13616
C	455	LYS	TYR	engineered mutation	UNP Q13616

- Molecule 2 is a protein called E3 ubiquitin-protein ligase RBX1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	84	692	438	127	118	9	0	0	0
2	D	85	701	443	128	121	9	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	3	GLY	-	expression tag	UNP P62877
B	4	SER	-	expression tag	UNP P62877
D	3	GLY	-	expression tag	UNP P62877
D	4	SER	-	expression tag	UNP P62877

- Molecule 3 is a protein called Glomulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	E	523	Total	C	N	O	S	0	0	0
			4202	2720	685	772	25			
3	F	512	Total	C	N	O	S	0	0	0
			4120	2676	666	753	25			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	-1	GLY	-	expression tag	UNP Q92990
E	0	SER	-	expression tag	UNP Q92990
F	-1	GLY	-	expression tag	UNP Q92990
F	0	SER	-	expression tag	UNP Q92990

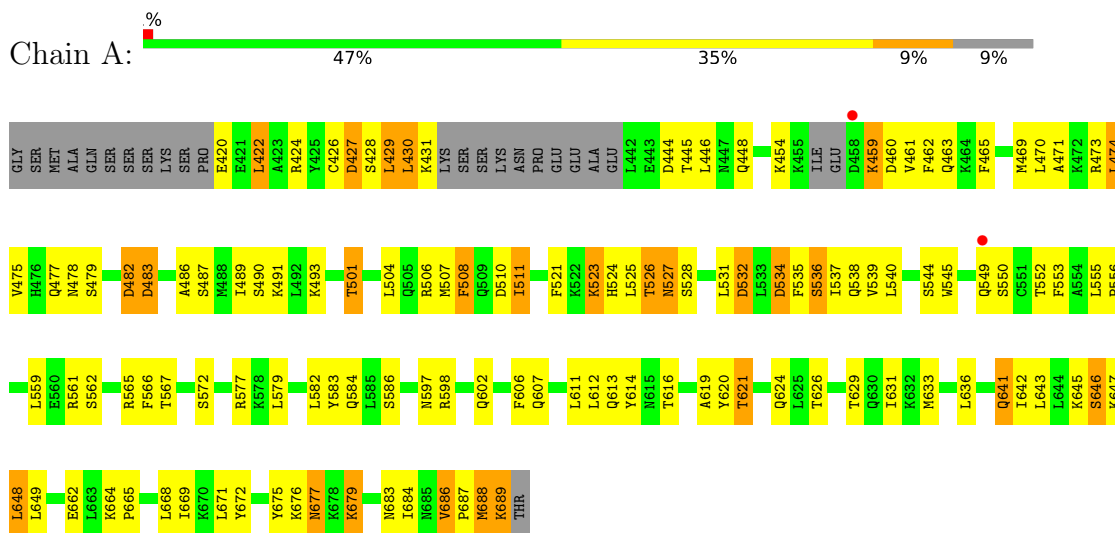
- Molecule 4 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	3	Total	Zn	0	0
			3	3		
4	D	3	Total	Zn	0	0
			3	3		

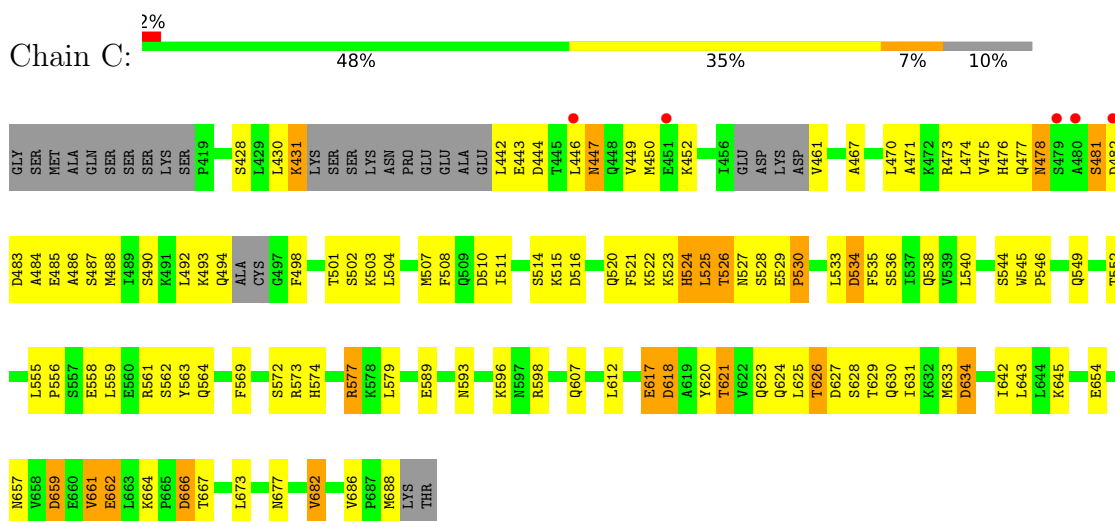
### 3 Residue-property plots

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: Cullin-1

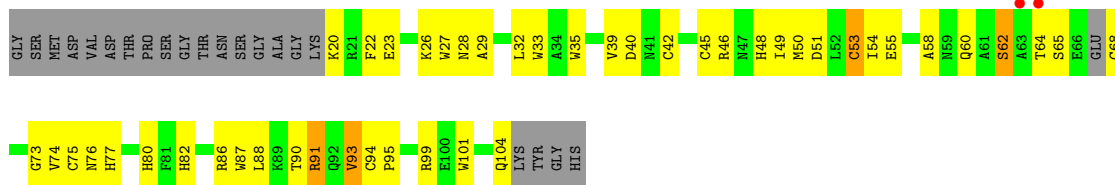


- Molecule 1: Cullin-1

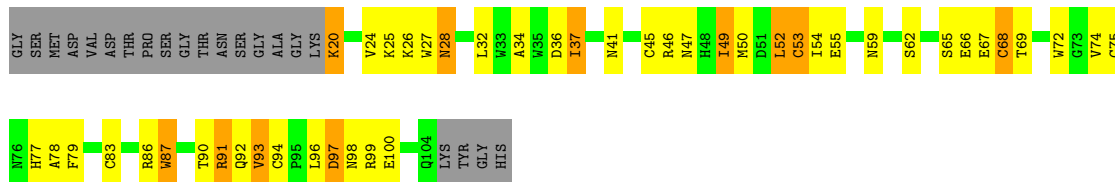
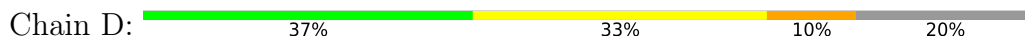


- Molecule 2: E3 ubiquitin-protein ligase RBX1

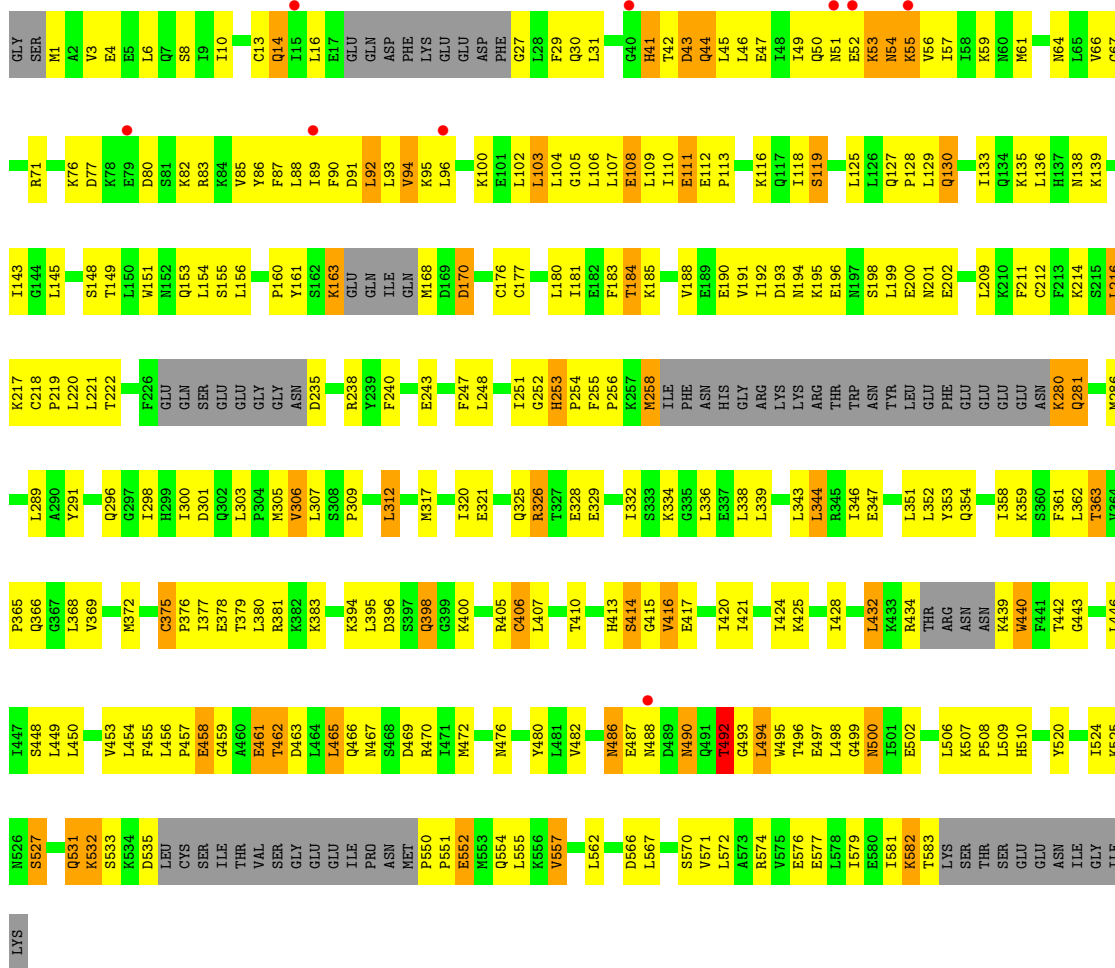




• Molecule 2: E3 ubiquitin-protein ligase RBX1



• Molecule 3: Glomulin



• Molecule 3: Glomulin



GLY	SER	M1	E5	L6	O7	S8	I9	I10	C13	Q14	I15	L16	E17	I18	Q19	ASP	PHE	K22	D25	F26	G27	Q30	L31	A32	G33	Q34	R35	E38	E39	GLY	HIS	THR	ASP	GLN	L45	L46	E47	L48	I49	Q50	N54	K55	V56	I57	K59	N60	M61	M63	N64	L65	V66							
C72	L73	L74	C75	ASP	LYS	GLU	ASP	S81	I85	I86	F87	L92	L93	N94	K95	L96	C97	N98	P99	L103	L104	G105	L106	L107	G107	E108	L109	I110	E111	E112	P113	S114	G115	K116	Q117	L118	S119	Q120	L48	S121	I122	L123	L124	L125	L126	Q127	P128	L129	Q130	N60	T131	V132	M61	I133	Q134	K135	H137	
M138	K139	A140	Y141	S142	I143	S148	T149	L150	W151	N152	Q153	L154	S155	L156	L157	P160	Y161	SER	LYS	GLU	Q165	I166	Q167	M168	D169	D170	C174	C177	K178	A179	L180	I181	E182	F183	T184	K185	P186	F187	V188	E189	E190	V191	I192	D193	ASN	LYS	L158	ASN	Q130	SER	T131	ARG	LEU	GLU	M201	E202	K203	L204
E207	F211	C212	F213	K214	S215	L216	K217	C218	P219	L220	Q224	F225	F226	GLU	GLN	SER	GLU	LYS	GLY	GLY	N234	D235	P236	F237	R238	Y239	F240	A241	S242	E243	I244	I245	G246	F247	L248	S249	A250	I251	G252	H253	P254	P255	P256	K257	M258	I259	PHE	ASN	L158	HIS	GLY	ARG	LEU	LYS	LYS	ARG	THR	TRP
ASN	TYR	LEU	PHE	GLU	GLU	GLU	N279	K280	Q281	L282	E283	D284	S285	M286	L289	A290	Y291	L292	V293	F294	V295	I298	H299	I300	D301	Q302	L303	P304	L307	L310	Y311	L312	N316	G318	H319	I320	E321	F323	R326	T327	E328	E329	S330	V331	I332	S333	K334	G335	L336									
E337	L338	L339	E340	N341	S342	L343	L344	D348	L351	L352	Y353	Q354	Y355	L356	E357	F361	L362	T363	V364	P365	Q366	G367	L368	V369	K370	V371	M372	L373	L374	C375	P376	I377	E378	T379	L380	R381	K382	K383	S384	L385	A386	M387	L388	Q389	L390	Y391	I392	L395	D396	S397	Q398	G399	K400	Y401	T402			
L403	F404	R405	C406	T410	S414	E417	A418	F419	I420	I421	Q422	N423	I424	Q427	I428	S431	L432	LYS	ARG	THR	ARG	ASN	ASN	ASN	K439	W440	F441	T442	G443	P444	Q445	L446	I447	S448	L449	L450	D451	L452	W453	L454	F455	L456	P457	E458	G459	A460	E461	T462	D463	S464	L465	Q466	N467	N476				
L477	L478	P550	F551	M552	Q554	L555	K556	V557	L558	H559	Q491	T492	G493	W495	T496	E497	L498	G499	N500	I501	E502	N503	N504	F505	L506	K507	P508	L509	H510	I511	G512	L513	M514	M515	S516	I524	S527	Q528	Q531	K532	SER	LYS	ASP	LEU	CYS	SER	ILE	THR	VAL	SER	GLY	GLU	GLU	ILE	PRO			
ASN	MET	P551	M552	Q554	L555	K556	V557	L558	H559	Q491	T492	G493	W495	T496	E497	L498	G499	N500	I501	E502	N503	N504	F505	L506	K507	P508	L509	H510	I511	G512	L513	M514	M515	S516	I524	S527	Q528	Q531	K532	SER	LYS	ASP	LEU	CYS	SER	ILE	THR	VAL	SER	GLY	GLU	GLU	ILE	PRO				



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	53.33Å 193.93Å 142.07Å 90.00° 98.81° 90.00°	Depositor
Resolution (Å)	37.39 – 3.00 45.83 – 3.00	Depositor EDS
% Data completeness (in resolution range)	98.8 (37.39-3.00) 98.8 (45.83-3.00)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.71 (at 3.01Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.7.1_743)	Depositor
R, $R_{free}$	0.219 , 0.289 0.229 , 0.295	Depositor DCC
$R_{free}$ test set	2838 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	83.5	Xtrriage
Anisotropy	0.590	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 85.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.033 for h,-k,-h-l	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	13897	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	109.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.52% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section:  
ZN

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	0.46	0/2136	0.62	0/2870
1	C	0.43	0/2106	0.61	0/2830
2	B	0.47	0/711	0.68	0/965
2	D	0.44	0/721	0.66	0/980
3	E	0.44	0/4269	0.63	0/5753
3	F	0.39	0/4184	0.60	0/5639
All	All	0.43	0/14127	0.62	0/19037

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	A	0	1
3	E	0	4
3	F	0	4
All	All	0	9

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 9 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	501	THR	Peptide
3	E	111	GLU	Peptide
3	E	432	LEU	Peptide
3	E	492	THR	Peptide

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Mol	Chain	Res	Type	Group
3	E	493	GLY	Peptide

## 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	2103	0	2127	117	0
1	C	2073	0	2101	118	0
2	B	692	0	647	48	0
2	D	701	0	654	44	0
3	E	4202	0	4360	271	0
3	F	4120	0	4271	277	0
4	B	3	0	0	0	0
4	D	3	0	0	0	0
All	All	13897	0	14160	820	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 29.

The worst 5 of 820 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:525:LEU:O	1:C:529:GLU:HB2	1.21	1.37
1:C:530:PRO:O	1:C:561:ARG:NH2	1.68	1.26
1:A:646:SER:OG	1:A:648:LEU:HD12	1.35	1.21
1:A:647:LYS:HB2	1:A:675:TYR:CE1	1.76	1.20
1:C:527:ASN:HD22	3:F:551:PRO:HB3	1.09	1.10

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	252/282 (89%)	225 (89%)	26 (10%)	1 (0%)	34	72
1	C	246/282 (87%)	228 (93%)	17 (7%)	1 (0%)	34	72
2	B	80/106 (76%)	72 (90%)	8 (10%)	0	100	100
2	D	83/106 (78%)	76 (92%)	6 (7%)	1 (1%)	13	48
3	E	509/596 (85%)	464 (91%)	44 (9%)	1 (0%)	47	82
3	F	492/596 (83%)	450 (92%)	40 (8%)	2 (0%)	34	72
All	All	1662/1968 (84%)	1515 (91%)	141 (8%)	6 (0%)	34	72

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	530	PRO
3	E	306	VAL
2	D	65	SER
3	F	113	PRO
1	A	489	ILE

### 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	237/258 (92%)	197 (83%)	40 (17%)	2	11
1	C	234/258 (91%)	199 (85%)	35 (15%)	3	14
2	B	74/90 (82%)	60 (81%)	14 (19%)	1	8
2	D	75/90 (83%)	59 (79%)	16 (21%)	1	5
3	E	481/548 (88%)	400 (83%)	81 (17%)	2	11
3	F	471/548 (86%)	391 (83%)	80 (17%)	2	10
All	All	1572/1792 (88%)	1306 (83%)	266 (17%)	2	11

5 of 266 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	F	330	SER
3	F	379	THR
3	F	560	SER
2	D	69	THR
2	D	53	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 38 such sidechains are listed below:

Mol	Chain	Res	Type
3	F	279	ASN
3	F	486	ASN
3	F	296	GLN
3	F	398	GLN
3	F	510	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](#)

Of 6 ligands modelled in this entry, 6 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 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 [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	258/282 (91%)	-0.09	2 (0%) 86 65	51, 88, 168, 204	0
1	C	254/282 (90%)	0.00	5 (1%) 65 36	60, 99, 174, 207	0
2	B	84/106 (79%)	-0.05	2 (2%) 59 30	52, 114, 156, 217	0
2	D	85/106 (80%)	-0.17	0 100 100	69, 100, 152, 169	0
3	E	523/596 (87%)	-0.10	9 (1%) 70 41	49, 99, 165, 213	0
3	F	512/596 (85%)	-0.08	7 (1%) 75 49	54, 119, 170, 212	0
All	All	1716/1968 (87%)	-0.08	25 (1%) 73 46	49, 104, 169, 217	0

The worst 5 of 25 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	F	46	LEU	5.4
3	E	488	ASN	3.8
1	C	480	ALA	3.7
3	F	307	LEU	3.1
1	A	549	GLN	3.0

### 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](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
4	ZN	B	201	1/1	0.96	0.21	91,91,91,91	0
4	ZN	B	203	1/1	0.98	0.14	112,112,112,112	0
4	ZN	B	202	1/1	0.99	0.18	96,96,96,96	0
4	ZN	D	201	1/1	0.99	0.20	79,79,79,79	0
4	ZN	D	202	1/1	0.99	0.10	120,120,120,120	0
4	ZN	D	203	1/1	0.99	0.19	101,101,101,101	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.