



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 15, 2026 – 01:02 PM UTC

PDB ID : 4NAW / pdb_00004naw
Title : Crystal Structure of Human ATG12 ATG5-ATG16N in complex with a fragment of ATG3
Authors : Metlagel, Z.; Otomo, C.; Takaesu, G.; Otomo, T.
Deposited on : 2013-10-22
Resolution : 2.19 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

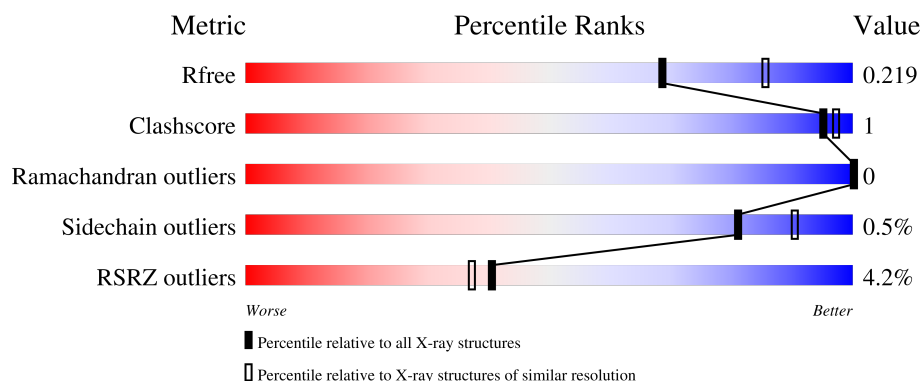
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.19 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}	180053	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	91	5% 95% ..
1	E	91	4% 96% ..
1	I	91	5% 91% 5% .
1	M	91	3% 95% ..
2	B	275	3% 95% ..

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Mol	Chain	Length	Quality of chain
2	F	275	
2	J	275	
2	N	275	
3	C	36	
3	G	36	
3	K	36	
3	O	36	
4	D	34	
4	H	34	
4	L	34	
4	P	34	

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 27188 atoms, of which 13255 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 Ubiquitin-like protein ATG12.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	88	Total	C	H	N	O	S	0	0	0
			1435	461	731	115	125	3			
1	E	88	Total	C	H	N	O	S	0	0	0
			1435	461	731	115	125	3			
1	I	88	Total	C	H	N	O	S	0	0	0
			1435	461	731	115	125	3			
1	M	88	Total	C	H	N	O	S	0	0	0
			1435	461	731	115	125	3			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	50	GLY	-	expression tag	UNP O94817
A	51	SER	-	expression tag	UNP O94817
E	50	GLY	-	expression tag	UNP O94817
E	51	SER	-	expression tag	UNP O94817
I	50	GLY	-	expression tag	UNP O94817
I	51	SER	-	expression tag	UNP O94817
M	50	GLY	-	expression tag	UNP O94817
M	51	SER	-	expression tag	UNP O94817

- Molecule 2 is a protein called Autophagy protein 5.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	266	Total	C	H	N	O	S	0	0	0
			4409	1440	2191	368	398	12			
2	F	265	Total	C	H	N	O	S	0	0	0
			4393	1436	2181	367	397	12			
2	J	263	Total	C	H	N	O	S	0	0	0
			4367	1427	2170	365	393	12			
2	N	264	Total	C	H	N	O	S	0	0	0
			4381	1432	2177	366	394	12			

- Molecule 3 is a protein called Autophagy-related protein 16-1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	C	34	Total 637	C 196	H 326	N 65	O 49	S 1	0	0	0
3	G	34	Total 637	C 196	H 326	N 65	O 49	S 1	0	0	0
3	K	34	Total 637	C 196	H 326	N 65	O 49	S 1	0	0	0
3	O	34	Total 637	C 196	H 326	N 65	O 49	S 1	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	8	SER	-	expression tag	UNP Q676U5
C	9	HIS	-	expression tag	UNP Q676U5
C	10	MET	-	expression tag	UNP Q676U5
G	8	SER	-	expression tag	UNP Q676U5
G	9	HIS	-	expression tag	UNP Q676U5
G	10	MET	-	expression tag	UNP Q676U5
K	8	SER	-	expression tag	UNP Q676U5
K	9	HIS	-	expression tag	UNP Q676U5
K	10	MET	-	expression tag	UNP Q676U5
O	8	SER	-	expression tag	UNP Q676U5
O	9	HIS	-	expression tag	UNP Q676U5
O	10	MET	-	expression tag	UNP Q676U5

- Molecule 4 is a protein called Ubiquitin-like-conjugating enzyme ATG3.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
4	D	13	Total 181	C 60	H 80	N 13	O 27	S 1	0	0	0
4	H	12	Total 166	C 55	H 74	N 12	O 24	S 1	0	0	0
4	L	12	Total 166	C 55	H 74	N 12	O 24	S 1	0	0	0
4	P	13	Total 181	C 60	H 80	N 13	O 27	S 1	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

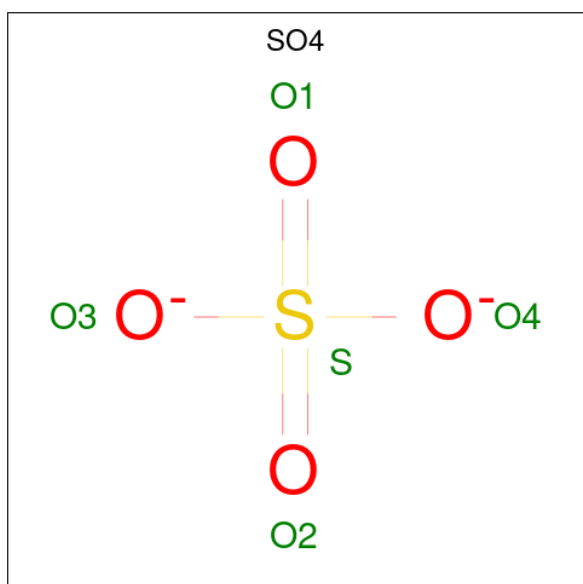
Chain	Residue	Modelled	Actual	Comment	Reference
D	137	GLY	-	expression tag	UNP Q9NT62

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Chain	Residue	Modelled	Actual	Comment	Reference
D	138	HIS	-	expression tag	UNP Q9NT62
D	139	MET	-	expression tag	UNP Q9NT62
H	137	GLY	-	expression tag	UNP Q9NT62
H	138	HIS	-	expression tag	UNP Q9NT62
H	139	MET	-	expression tag	UNP Q9NT62
L	137	GLY	-	expression tag	UNP Q9NT62
L	138	HIS	-	expression tag	UNP Q9NT62
L	139	MET	-	expression tag	UNP Q9NT62
P	137	GLY	-	expression tag	UNP Q9NT62
P	138	HIS	-	expression tag	UNP Q9NT62
P	139	MET	-	expression tag	UNP Q9NT62

- Molecule 5 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	B	1	Total	O	S	0	0
			5	4	1		
5	B	1	Total	O	S	0	0
			5	4	1		
5	F	1	Total	O	S	0	0
			5	4	1		
5	F	1	Total	O	S	0	0
			5	4	1		
5	J	1	Total	O	S	0	0
			5	4	1		
5	J	1	Total	O	S	0	0
			5	4	1		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	J	1	Total	O	S	0	0
			5	4	1		
5	J	1	Total	O	S	0	0
			5	4	1		
5	N	1	Total	O	S	0	0
			5	4	1		
5	N	1	Total	O	S	0	0
			5	4	1		
5	N	1	Total	O	S	0	0
			5	4	1		

- Molecule 6 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	B	1	Total	Na	0	0
			1	1		
6	F	1	Total	Na	0	0
			1	1		
6	J	1	Total	Na	0	0
			1	1		
6	N	1	Total	Na	0	0
			1	1		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	17	Total	O	0	0
			17	17		
7	B	132	Total	O	0	0
			132	132		
7	C	19	Total	O	0	0
			19	19		
7	E	23	Total	O	0	0
			23	23		
7	F	117	Total	O	0	0
			117	117		
7	G	17	Total	O	0	0
			17	17		
7	I	15	Total	O	0	0
			15	15		
7	J	130	Total	O	0	0
			130	130		

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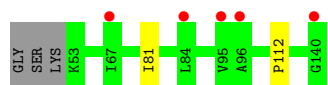
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	K	16	Total 16	O 16	0	0
7	L	1	Total 1	O 1	0	0
7	M	13	Total 13	O 13	0	0
7	N	82	Total 82	O 82	0	0
7	O	15	Total 15	O 15	0	0

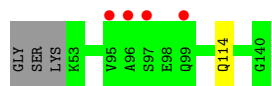
3 Residue-property plots [i](#)

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.

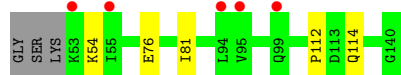
- Molecule 1: Ubiquitin-like protein ATG12



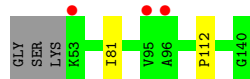
- Molecule 1: Ubiquitin-like protein ATG12



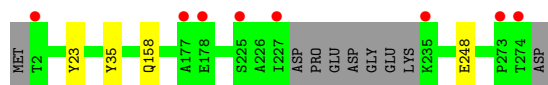
- Molecule 1: Ubiquitin-like protein ATG12



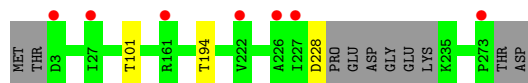
- Molecule 1: Ubiquitin-like protein ATG12



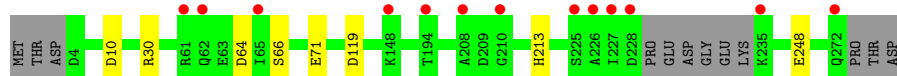
- Molecule 2: Autophagy protein 5



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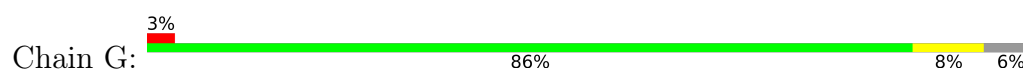
- Molecule 2: Autophagy protein 5



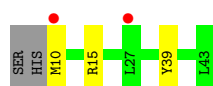
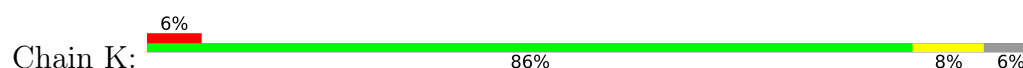
- Molecule 3: Autophagy-related protein 16-1



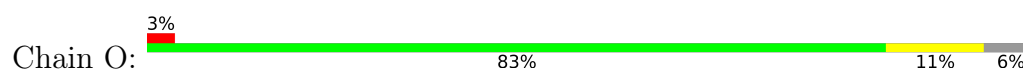
- Molecule 3: Autophagy-related protein 16-1



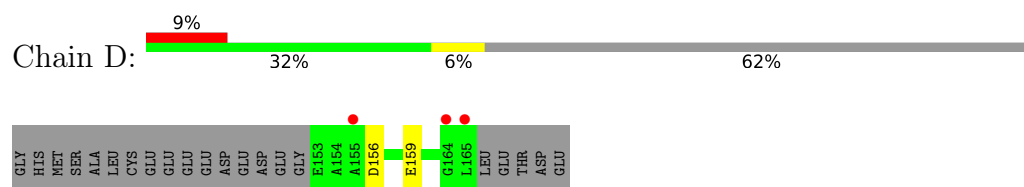
- Molecule 3: Autophagy-related protein 16-1



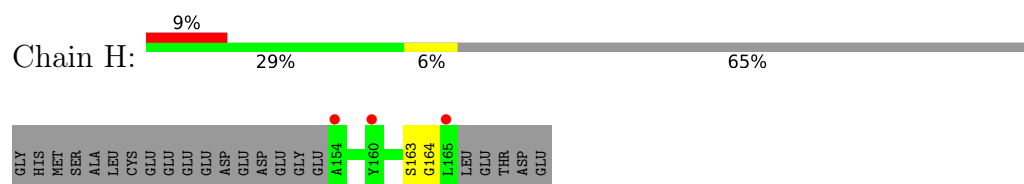
- Molecule 3: Autophagy-related protein 16-1



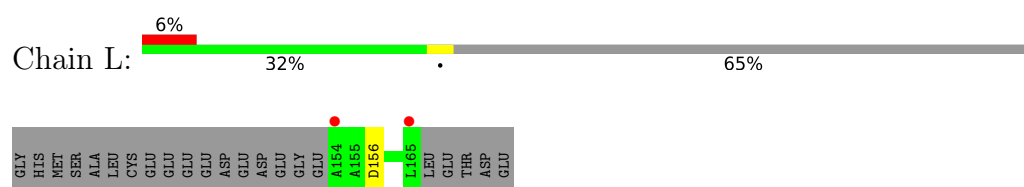
- Molecule 4: Ubiquitin-like-conjugating enzyme ATG3



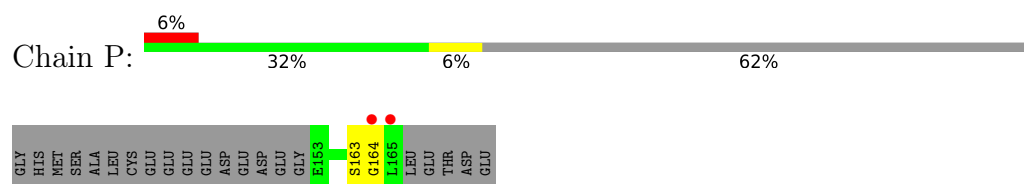
- Molecule 4: Ubiquitin-like-conjugating enzyme ATG3



- Molecule 4: Ubiquitin-like-conjugating enzyme ATG3



- Molecule 4: Ubiquitin-like-conjugating enzyme ATG3



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	93.58Å 120.10Å 189.47Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.83 – 2.19 48.83 – 2.19	Depositor EDS
% Data completeness (in resolution range)	99.6 (48.83-2.19) 99.4 (48.83-2.19)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.76 (at 2.20Å)	Xtriage
Refinement program	PHENIX 1.8.2_1309	Depositor
R, R_{free}	0.172 , 0.215 0.176 , 0.219	Depositor DCC
R_{free} test set	2000 reflections (1.83%)	wwPDB-VP
Wilson B-factor (Å ²)	39.1	Xtriage
Anisotropy	0.316	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 45.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	27188	wwPDB-VP
Average B, all atoms (Å ²)	66.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.17% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, NA

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	0.25	0/719	0.56	0/968
1	E	0.26	0/719	0.58	0/968
1	I	0.27	0/719	0.57	0/968
1	M	0.26	0/719	0.58	0/968
2	B	0.31	0/2284	0.58	0/3098
2	F	0.31	0/2278	0.58	0/3089
2	J	0.31	0/2262	0.61	0/3066
2	N	0.29	0/2270	0.60	0/3078
3	C	0.34	0/316	0.52	0/420
3	G	0.33	0/316	0.51	0/420
3	K	0.33	0/316	0.51	0/420
3	O	0.32	0/316	0.56	0/420
4	D	0.22	0/101	0.49	0/134
4	H	0.25	0/92	0.51	0/122
4	L	0.27	0/92	0.56	0/122
4	P	0.34	0/101	0.59	0/134
All	All	0.30	0/13620	0.58	0/18395

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

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	704	731	730	1	0
1	E	704	731	730	0	0
1	I	704	731	730	3	0
1	M	704	731	730	1	0
2	B	2218	2191	2181	3	0
2	F	2212	2181	2171	2	0
2	J	2197	2170	2160	8	0
2	N	2204	2177	2167	4	0
3	C	311	326	325	3	0
3	G	311	326	325	2	0
3	K	311	326	325	2	0
3	O	311	326	325	3	0
4	D	101	80	80	1	0
4	H	92	74	74	1	0
4	L	92	74	74	1	0
4	P	101	80	80	1	0
5	B	10	0	0	0	0
5	F	10	0	0	0	0
5	J	20	0	0	0	0
5	N	15	0	0	0	0
6	B	1	0	0	0	0
6	F	1	0	0	0	0
6	J	1	0	0	0	0
6	N	1	0	0	0	0
7	A	17	0	0	0	0
7	B	132	0	0	2	0
7	C	19	0	0	2	0
7	E	23	0	0	0	0
7	F	117	0	0	2	0
7	G	17	0	0	1	0
7	I	15	0	0	1	0
7	J	130	0	0	6	0
7	K	16	0	0	0	0
7	L	1	0	0	0	0
7	M	13	0	0	0	0
7	N	82	0	0	2	0
7	O	15	0	0	0	0
All	All	13933	13255	13207	31	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 1.

All (31) 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)
2:J:64:ASP:O	7:J:526:HOH:O	1.84	0.93
2:N:164:GLN:OE1	7:N:465:HOH:O	1.90	0.89
2:J:66:SER:O	7:J:479:HOH:O	1.96	0.81
2:J:10:ASP:OD2	7:J:529:HOH:O	2.03	0.77
2:J:213:HIS:O	7:J:465:HOH:O	2.02	0.76
2:J:30:ARG:NH1	7:J:475:HOH:O	2.19	0.75
1:I:114:GLN:OE1	7:I:201:HOH:O	2.04	0.74
2:F:194:THR:OG1	7:F:423:HOH:O	2.08	0.72
2:N:10:ASP:OD2	7:N:467:HOH:O	2.07	0.72
2:N:61:ARG:NH1	2:N:63:GLU:OE2	2.24	0.70
3:O:10:MET:O	3:O:15:ARG:NH2	2.26	0.68
2:F:101:THR:OG1	7:F:437:HOH:O	2.13	0.65
3:C:20:GLN:NE2	7:C:105:HOH:O	2.28	0.61
3:K:10:MET:O	3:K:15:ARG:NH1	2.34	0.60
2:B:248:GLU:OE2	7:B:519:HOH:O	2.16	0.59
2:J:248:GLU:N	2:J:248:GLU:OE1	2.36	0.58
2:B:35:TYR:OH	7:B:468:HOH:O	2.17	0.58
3:C:33:GLU:OE1	7:C:112:HOH:O	2.18	0.51
1:I:54:LYS:NZ	4:L:156:ASP:OD1	2.39	0.51
2:J:71:GLU:OE1	7:J:502:HOH:O	2.19	0.50
4:H:163:SER:OG	4:H:164:GLY:N	2.46	0.47
1:M:81:ILE:HB	1:M:112:PRO:HA	1.97	0.47
3:G:20:GLN:NE2	7:G:108:HOH:O	2.47	0.47
2:B:23:TYR:OH	2:J:119:ASP:OD2	2.31	0.47
4:D:156:ASP:OD2	4:D:159:GLU:N	2.48	0.44
4:P:163:SER:OG	4:P:164:GLY:N	2.52	0.42
3:K:39:TYR:CE1	3:O:38:GLN:HG3	2.55	0.42
3:C:38:GLN:HG3	3:G:39:TYR:CE1	2.54	0.42
1:A:81:ILE:HB	1:A:112:PRO:HA	2.01	0.41
2:N:246:MET:HE2	3:O:13:TRP:HA	2.03	0.41
1:I:81:ILE:HB	1:I:112:PRO:HA	2.03	0.40

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	86/91 (94%)	84 (98%)	2 (2%)	0	100	100
1	E	86/91 (94%)	84 (98%)	2 (2%)	0	100	100
1	I	86/91 (94%)	84 (98%)	2 (2%)	0	100	100
1	M	86/91 (94%)	83 (96%)	3 (4%)	0	100	100
2	B	262/275 (95%)	257 (98%)	5 (2%)	0	100	100
2	F	261/275 (95%)	253 (97%)	8 (3%)	0	100	100
2	J	259/275 (94%)	255 (98%)	4 (2%)	0	100	100
2	N	260/275 (94%)	257 (99%)	3 (1%)	0	100	100
3	C	32/36 (89%)	31 (97%)	1 (3%)	0	100	100
3	G	32/36 (89%)	32 (100%)	0	0	100	100
3	K	32/36 (89%)	32 (100%)	0	0	100	100
3	O	32/36 (89%)	32 (100%)	0	0	100	100
4	D	11/34 (32%)	10 (91%)	1 (9%)	0	100	100
4	H	10/34 (29%)	7 (70%)	3 (30%)	0	100	100
4	L	10/34 (29%)	8 (80%)	2 (20%)	0	100	100
4	P	11/34 (32%)	9 (82%)	2 (18%)	0	100	100
All	All	1556/1744 (89%)	1518 (98%)	38 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	77/79 (98%)	77 (100%)	0	100	100
1	E	77/79 (98%)	76 (99%)	1 (1%)	61	76
1	I	77/79 (98%)	76 (99%)	1 (1%)	61	76

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	M	77/79 (98%)	77 (100%)	0	100	100
2	B	246/254 (97%)	245 (100%)	1 (0%)	84	92
2	F	245/254 (96%)	244 (100%)	1 (0%)	84	92
2	J	243/254 (96%)	243 (100%)	0	100	100
2	N	244/254 (96%)	242 (99%)	2 (1%)	73	85
3	C	33/35 (94%)	33 (100%)	0	100	100
3	G	33/35 (94%)	32 (97%)	1 (3%)	36	49
3	K	33/35 (94%)	33 (100%)	0	100	100
3	O	33/35 (94%)	33 (100%)	0	100	100
4	D	10/28 (36%)	10 (100%)	0	100	100
4	H	9/28 (32%)	9 (100%)	0	100	100
4	L	9/28 (32%)	9 (100%)	0	100	100
4	P	10/28 (36%)	10 (100%)	0	100	100
All	All	1456/1584 (92%)	1449 (100%)	7 (0%)	81	90

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	158	GLN
1	E	114	GLN
2	F	228	ASP
3	G	37	LEU
1	I	76	GLU
2	N	58	LYS
2	N	110	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	82	GLN
2	F	158	GLN
2	F	237	GLN
1	I	82	GLN
3	K	20	GLN
3	K	30	GLN
3	K	40	ASN

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Mol	Chain	Res	Type
1	M	82	GLN
2	N	237	GLN
2	N	241	HIS
3	O	40	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 15 ligands modelled in this entry, 4 are monoatomic - leaving 11 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
5	SO4	J	303	-	4,4,4	0.24	0	6,6,6	0.09	0
5	SO4	J	304	-	4,4,4	0.24	0	6,6,6	0.08	0
5	SO4	N	301	-	4,4,4	0.25	0	6,6,6	0.09	0
5	SO4	F	301	-	4,4,4	0.23	0	6,6,6	0.06	0
5	SO4	B	302	-	4,4,4	0.23	0	6,6,6	0.11	0
5	SO4	B	301	-	4,4,4	0.25	0	6,6,6	0.14	0
5	SO4	F	302	-	4,4,4	0.24	0	6,6,6	0.07	0
5	SO4	J	302	-	4,4,4	0.23	0	6,6,6	0.08	0
5	SO4	N	303	-	4,4,4	0.24	0	6,6,6	0.07	0
5	SO4	N	302	-	4,4,4	0.23	0	6,6,6	0.04	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
5	SO4	J	301	-	4,4,4	0.23	0	6,6,6	0.07	0

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 [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

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(Å ²)	Q<0.9
1	A	88/91 (96%)	0.65	5 (5%) 29 26	51, 81, 116, 122	0
1	E	88/91 (96%)	0.58	4 (4%) 38 35	46, 77, 122, 140	0
1	I	88/91 (96%)	0.71	5 (5%) 29 26	46, 81, 116, 134	0
1	M	88/91 (96%)	0.71	3 (3%) 48 45	59, 90, 122, 129	0
2	B	266/275 (96%)	-0.11	8 (3%) 52 49	34, 49, 93, 115	0
2	F	265/275 (96%)	-0.02	7 (2%) 57 54	34, 52, 94, 117	0
2	J	263/275 (95%)	0.08	13 (4%) 35 31	34, 55, 102, 135	0
2	N	264/275 (96%)	0.29	8 (3%) 52 49	38, 66, 111, 130	0
3	C	34/36 (94%)	0.05	0 100 100	36, 50, 82, 99	0
3	G	34/36 (94%)	0.12	1 (2%) 53 50	39, 57, 85, 101	0
3	K	34/36 (94%)	0.23	2 (5%) 28 25	41, 64, 104, 121	0
3	O	34/36 (94%)	0.01	1 (2%) 53 50	39, 53, 99, 120	0
4	D	13/34 (38%)	1.60	3 (23%) 2 1	88, 102, 123, 135	0
4	H	12/34 (35%)	1.46	3 (25%) 2 1	92, 98, 115, 117	0
4	L	12/34 (35%)	1.48	2 (16%) 4 3	84, 90, 110, 113	0
4	P	13/34 (38%)	1.26	2 (15%) 5 4	95, 102, 120, 133	0
All	All	1596/1744 (91%)	0.24	67 (4%) 40 37	34, 62, 110, 140	0

All (67) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	D	165	LEU	5.8
2	B	274	THR	5.3
4	L	165	LEU	5.1
2	F	227	ILE	4.5
2	N	273	PRO	4.5

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Mol	Chain	Res	Type	RSRZ
4	H	165	LEU	4.3
4	P	165	LEU	4.2
2	N	227	ILE	4.1
2	F	273	PRO	4.1
4	L	154	ALA	4.0
4	D	164	GLY	4.0
2	J	228	ASP	3.8
2	J	235	LYS	3.7
1	E	95	VAL	3.7
2	B	227	ILE	3.7
2	J	208	ALA	3.7
2	N	3	ASP	3.6
2	N	208	ALA	3.5
2	F	3	ASP	3.5
1	M	96	ALA	3.4
4	H	154	ALA	3.4
1	A	95	VAL	3.2
4	P	164	GLY	3.2
1	M	95	VAL	3.1
2	B	273	PRO	3.0
1	A	140	GLY	2.9
1	I	99	GLN	2.8
3	G	10	MET	2.8
2	J	65	ILE	2.7
1	E	96	ALA	2.7
2	J	62	GLN	2.6
2	F	226	ALA	2.6
1	A	96	ALA	2.6
2	B	2	THR	2.5
2	J	194	THR	2.5
1	I	53	LYS	2.5
2	N	75	THR	2.5
2	B	225	SER	2.4
1	M	53	LYS	2.4
2	J	148	LYS	2.4
2	B	235	LYS	2.4
1	E	99	GLN	2.3
2	F	222	VAL	2.3
2	J	225	SER	2.3
2	F	27	ILE	2.3
2	B	178	GLU	2.2
2	J	227	ILE	2.2

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Mol	Chain	Res	Type	RSRZ
2	B	177	ALA	2.2
1	E	97	SER	2.2
3	K	10	MET	2.2
1	A	84	LEU	2.2
2	J	61	ARG	2.2
1	I	94	LEU	2.1
3	O	10	MET	2.1
4	H	160	TYR	2.1
1	I	55	ILE	2.1
1	I	95	VAL	2.1
2	N	235	LYS	2.1
3	K	27	LEU	2.1
2	N	60	MET	2.1
2	F	161	ARG	2.1
4	D	155	ALA	2.1
2	J	272	GLN	2.0
2	J	210	GLY	2.0
1	A	67	ILE	2.0
2	J	226	ALA	2.0
2	N	193	THR	2.0

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 oligosaccharides 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, 95th 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 ²)	Q<0.9
5	SO4	J	302	5/5	0.63	0.16	110,117,125,135	0
5	SO4	N	303	5/5	0.75	0.14	70,79,101,116	0
6	NA	J	305	1/1	0.75	0.19	72,72,72,72	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	SO4	N	302	5/5	0.78	0.09	100,110,111,116	0
5	SO4	J	303	5/5	0.80	0.10	103,112,116,117	0
6	NA	N	304	1/1	0.81	0.11	69,69,69,69	0
5	SO4	J	304	5/5	0.83	0.15	80,99,122,135	0
5	SO4	F	301	5/5	0.87	0.13	110,113,126,127	0
5	SO4	N	301	5/5	0.88	0.14	58,74,79,85	0
5	SO4	J	301	5/5	0.90	0.09	79,92,104,105	0
5	SO4	F	302	5/5	0.94	0.08	76,78,92,93	0
5	SO4	B	301	5/5	0.94	0.08	52,61,73,74	0
5	SO4	B	302	5/5	0.98	0.06	42,48,52,56	0
6	NA	B	303	1/1	0.98	0.04	41,41,41,41	0
6	NA	F	303	1/1	0.99	0.09	39,39,39,39	0

6.5 Other polymers [i](#)

There are no such residues in this entry.