



wwPDB EM Map/Model Validation Report ⓘ

Apr 10, 2016 – 01:52 PM BST

PDB ID : 3JBJ
EMDB ID: : EMD-6448
Title : Cryo-EM reconstruction of F-actin
Authors : Kim, L.Y.; Thompson, P.M.; Lee, H.T.; Pershad, M.; Campbell, S.L.; Alushin, G.M.
Deposited on : 2015-09-03
Resolution : 7.60 Å(reported)
Based on PDB ID : 3J8A

This is a wwPDB EM Map/Model Validation Report for a publicly released PDB/EMDB entry.
For rigid body fitted models, validation errors reported here could stem from errors in the original structure(s) used in the fitting.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<http://wwpdb.org/validation/2016/EMValidationReportHelp>

MolProbity : 4.02b-467
Mogul : 1.7.1 (RC1), CSD as537be (2016)
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : trunk27241

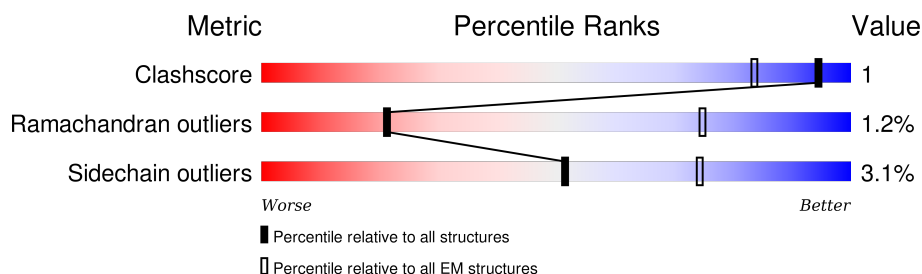
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 7.60 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)	EM structures (#Entries)
Clashscore	114402	924
Ramachandran outliers	111179	726
Sidechain outliers	111093	686

The table below summarises the geometric issues observed across the polymeric chains. The red, orange, yellow and green segments on the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	A	375	 87% 8% . .
1	B	375	 90% 7% . .

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 5778 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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.

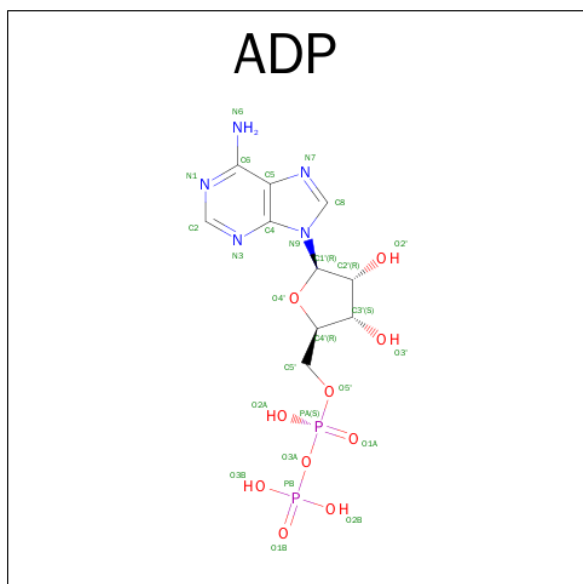
- Molecule 1 is a protein called Actin, alpha skeletal muscle.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	367	Total	C	N	O	S	0	0
			2861	1812	481	548	20		
1	B	367	Total	C	N	O	S	0	0
			2861	1812	481	548	20		

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
2	B	1	Total	Mg	0
			1	1	
2	A	1	Total	Mg	0
			1	1	

- Molecule 3 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$).

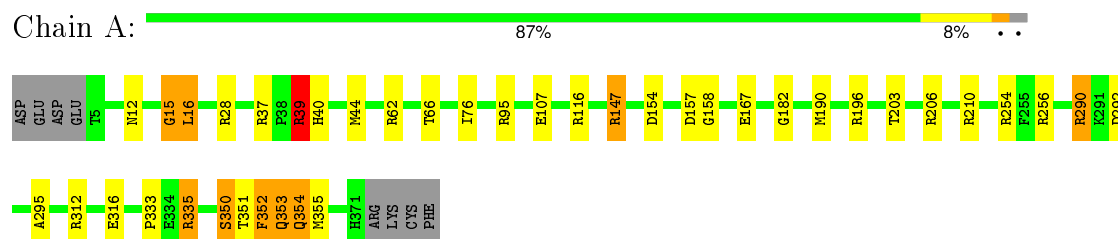


Mol	Chain	Residues	Atoms					AltConf
3	A	1	Total	C	N	O	P	0
			27	10	5	10	2	
3	B	1	Total	C	N	O	P	0
			27	10	5	10	2	

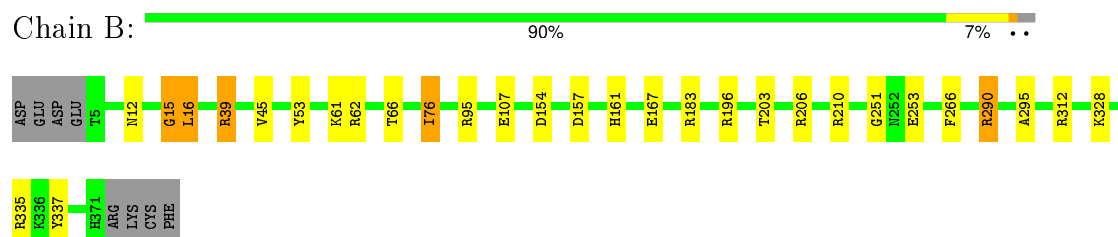
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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. 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: Actin, alpha skeletal muscle



- Molecule 1: Actin, alpha skeletal muscle



4 Experimental information

Property	Value	Source
Reconstruction method	HELICAL	Depositor
Imposed symmetry	POINT, Not provided	Depositor
Number of images	Not provided	Depositor
Resolution determination method	FSC 0.143	Depositor
CTF correction method	FREALIGN (per segment)	Depositor
Microscope	FEI TECNAI 20	Depositor
Voltage (kV)	120	Depositor
Electron dose ($e^-/\text{\AA}^2$)	25	Depositor
Minimum defocus (nm)	1500	Depositor
Maximum defocus (nm)	3000	Depositor
Magnification	100000	Depositor
Image detector	GATAN ULTRASCAN 4000 (4k x 4k)	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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

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	$\# Z > 2$	RMSZ	$\# Z > 2$
1	A	0.74	1/2923 (0.0%)	1.16	27/3963 (0.7%)
1	B	0.71	0/2923	1.10	14/3963 (0.4%)
All	All	0.72	1/5846 (0.0%)	1.13	41/7926 (0.5%)

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	7
1	B	0	6
All	All	0	13

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	354	GLN	CA-CB	5.53	1.66	1.53

All (41) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	353	GLN	CA-CB-CG	9.47	134.24	113.40
1	A	290	ARG	NE-CZ-NH1	8.74	124.67	120.30
1	A	62	ARG	NE-CZ-NH2	-8.33	116.14	120.30
1	A	256	ARG	NE-CZ-NH1	8.20	124.40	120.30
1	B	53	TYR	CB-CG-CD1	7.38	125.43	121.00
1	B	154	ASP	CB-CG-OD1	7.37	124.94	118.30
1	B	53	TYR	CB-CG-CD2	-7.20	116.68	121.00
1	A	353	GLN	C-N-CA	7.01	139.23	121.70

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	266	PHE	CB-CG-CD1	6.58	125.41	120.80
1	A	196	ARG	NE-CZ-NH1	6.55	123.58	120.30
1	A	95	ARG	NE-CZ-NH1	6.54	123.57	120.30
1	A	39	ARG	NE-CZ-NH1	6.44	123.52	120.30
1	A	147	ARG	NE-CZ-NH1	6.44	123.52	120.30
1	A	354	GLN	N-CA-CB	6.35	122.04	110.60
1	A	62	ARG	NE-CZ-NH1	6.33	123.46	120.30
1	A	312	ARG	NE-CZ-NH1	6.23	123.42	120.30
1	A	116	ARG	NE-CZ-NH2	-6.20	117.20	120.30
1	B	196	ARG	NE-CZ-NH2	-6.19	117.20	120.30
1	B	266	PHE	CB-CG-CD2	-6.04	116.57	120.80
1	B	183	ARG	NE-CZ-NH1	6.03	123.32	120.30
1	A	210	ARG	NE-CZ-NH2	-5.96	117.32	120.30
1	B	39	ARG	NE-CZ-NH1	5.91	123.26	120.30
1	B	337	TYR	CB-CG-CD2	-5.86	117.48	121.00
1	B	290	ARG	NE-CZ-NH1	5.84	123.22	120.30
1	A	95	ARG	NE-CZ-NH2	-5.80	117.40	120.30
1	B	15	GLY	C-N-CA	5.80	136.19	121.70
1	A	350	SER	CB-CA-C	5.67	120.86	110.10
1	A	206	ARG	NE-CZ-NH2	-5.66	117.47	120.30
1	B	62	ARG	NE-CZ-NH1	5.53	123.07	120.30
1	A	116	ARG	NE-CZ-NH1	5.51	123.06	120.30
1	A	15	GLY	C-N-CA	5.32	135.01	121.70
1	B	312	ARG	NE-CZ-NH1	5.32	122.96	120.30
1	A	210	ARG	NE-CZ-NH1	5.28	122.94	120.30
1	B	154	ASP	OD1-CG-OD2	-5.26	113.30	123.30
1	A	39	ARG	NE-CZ-NH2	-5.24	117.68	120.30
1	A	335	ARG	NE-CZ-NH1	5.23	122.91	120.30
1	A	353	GLN	CA-C-O	5.22	131.06	120.10
1	A	154	ASP	CB-CG-OD1	5.13	122.92	118.30
1	A	154	ASP	CB-CG-OD2	5.09	122.88	118.30
1	A	196	ARG	NE-CZ-NH2	-5.03	117.79	120.30
1	A	206	ARG	NE-CZ-NH1	5.03	122.81	120.30

There are no chirality outliers.

All (13) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	147	ARG	Sidechain
1	A	254	ARG	Sidechain
1	A	28	ARG	Sidechain
1	A	290	ARG	Sidechain

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Group
1	A	335	ARG	Sidechain
1	A	37	ARG	Sidechain
1	A	39	ARG	Sidechain
1	B	206	ARG	Sidechain
1	B	210	ARG	Sidechain
1	B	290	ARG	Sidechain
1	B	335	ARG	Sidechain
1	B	39	ARG	Sidechain
1	B	95	ARG	Sidechain

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	2861	0	2831	14	0
1	B	2861	0	2831	3	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	27	0	12	0	0
3	B	27	0	12	0	0
All	All	5778	0	5686	17	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 (17) 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:352:PHE:CD2	1:A:355:MET:SD	2.73	0.81
1:A:352:PHE:HD2	1:A:355:MET:SD	2.15	0.68
1:A:352:PHE:HB2	1:A:355:MET:HG3	1.80	0.62
1:A:351:THR:C	1:A:353:GLN:H	2.09	0.55
1:A:352:PHE:HB2	1:A:355:MET:SD	2.47	0.54
1:A:352:PHE:C	1:A:354:GLN:H	2.11	0.52
1:A:158:GLY:HA2	1:A:182:GLY:H	1.76	0.49
1:A:352:PHE:HB2	1:A:355:MET:CG	2.42	0.49

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:352:PHE:C	1:A:354:GLN:N	2.67	0.48
1:A:351:THR:O	1:A:353:GLN:N	2.39	0.47
1:B:76:ILE:H	1:B:76:ILE:HD13	1.80	0.46
1:B:15:GLY:HA3	1:B:16:LEU:HB2	1.97	0.46
1:B:295:ALA:HA	1:B:328:LYS:H	1.81	0.45
1:A:350:SER:HA	1:A:351:THR:HA	1.74	0.45
1:A:15:GLY:HA3	1:A:16:LEU:HB2	2.00	0.43
1:A:352:PHE:HD2	1:A:355:MET:HB2	1.83	0.43
1:A:39:ARG:HH11	1:A:40:HIS:HE2	1.66	0.41

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 PDB entries followed by that with respect to all EM entries.

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	365/375 (97%)	330 (90%)	30 (8%)	5 (1%)	14	58
1	B	365/375 (97%)	329 (90%)	32 (9%)	4 (1%)	17	63
All	All	730/750 (97%)	659 (90%)	62 (8%)	9 (1%)	21	61

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	16	LEU
1	A	16	LEU
1	A	167	GLU
1	B	167	GLU
1	A	352	PHE
1	A	295	ALA
1	B	45	VAL
1	B	251	GLY
1	A	333	PRO

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 PDB entries followed by that with respect to all EM entries.

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	310/318 (98%)	300 (97%)	10 (3%)	46	76
1	B	310/318 (98%)	301 (97%)	9 (3%)	50	78
All	All	620/636 (98%)	601 (97%)	19 (3%)	51	77

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	12	ASN
1	A	44	MET
1	A	66	THR
1	A	76	ILE
1	A	107	GLU
1	A	157	ASP
1	A	190	MET
1	A	203	THR
1	A	292	ASP
1	A	316	GLU
1	B	12	ASN
1	B	61	LYS
1	B	66	THR
1	B	76	ILE
1	B	107	GLU
1	B	157	ASP
1	B	161	HIS
1	B	203	THR
1	B	253	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	88	HIS
1	A	92	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry ⓘ

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 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	$\# Z > 2$
3	ADP	A	402	2	24,29,29	0.70	0	23,45,45	1.03	2 (8%)
3	ADP	B	402	2	24,29,29	0.77	0	23,45,45	1.55	2 (8%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	ADP	A	402	2	-	0/12/32/32	0/3/3/3
3	ADP	B	402	2	-	0/12/32/32	0/3/3/3

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
3	B	402	ADP	O3B-PB-O1B	-5.62	92.28	110.63
3	A	402	ADP	C4'-O4'-C1'	-2.03	107.50	109.64
3	A	402	ADP	O2A-PA-O3A	2.09	114.21	105.27
3	B	402	ADP	O3B-PB-O2B	2.11	115.19	107.44

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.