



wwPDB EM Map/Model Validation Report ⓘ

Apr 10, 2016 – 01:37 PM BST

PDB ID : 3A5X
EMDB ID: : EMD-1641
Title : L-type straight flagellar filament made of full-length flagellin
Authors : Maki-Yonekura, S.; Yonekura, K.; Namba, K.
Deposited on : 2009-08-13
Resolution : 4.00 Å(reported)

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 : unknown
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

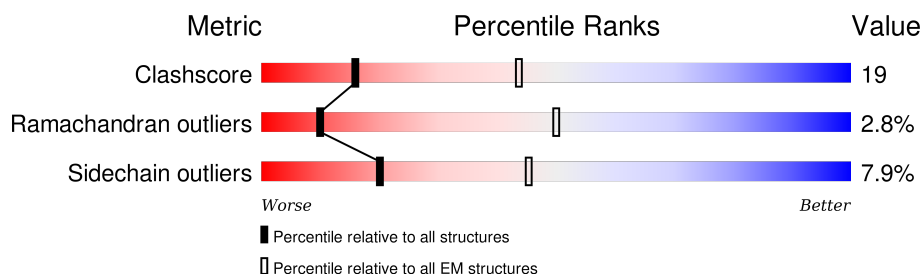
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 4.00 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)	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	494	

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 3616 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 Flagellin.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	494	Total	C	N	O	S	0	0
			3616	2190	640	784	2		

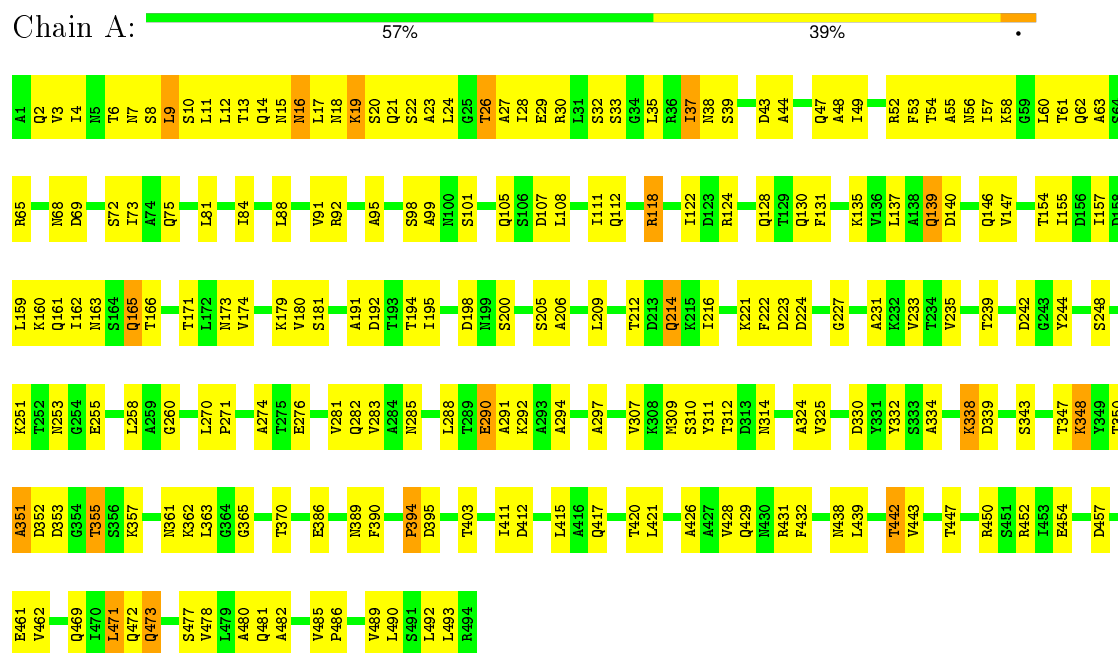
There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	426	ALA	GLY	SEE REMARK 999	UNP P06179

3 Residue-property plots

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: Flagellin



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	Not provided	Depositor
CTF correction method	Both amplitude and phase	Depositor
Microscope	JEOL JEM-3000SFF	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	2000.00	Depositor
Minimum defocus (nm)	1080.00	Depositor
Maximum defocus (nm)	2220.00	Depositor
Magnification	50000	Depositor
Image detector	KODAK SO163 FILM	Depositor

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	$\# Z > 2$	RMSZ	$\# Z > 2$
1	A	0.63	0/3639	0.75	1/4940 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	492	LEU	CA-CB-CG	5.15	127.14	115.30

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	3616	0	3578	136	0
All	All	3616	0	3578	136	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 19.

All (136) 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:130:GLN:HB3	1:A:135:LYS:HD3	1.56	0.88
1:A:288:LEU:HB2	1:A:292:LYS:HE3	1.54	0.86

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:146:GLN:HA	1:A:154:THR:HG22	1.57	0.85
1:A:55:ALA:HA	1:A:58:LYS:HD2	1.61	0.83
1:A:216:ILE:HG23	1:A:231:ALA:HB1	1.62	0.81
1:A:160:LYS:HG3	1:A:421:LEU:HD22	1.63	0.79
1:A:157:ILE:HG12	1:A:428:VAL:HG11	1.64	0.78
1:A:338:LYS:HD2	1:A:339:ASP:H	1.50	0.77
1:A:270:LEU:HD12	1:A:271:PRO:HD2	1.68	0.74
1:A:92:ARG:HH21	1:A:415:LEU:HD12	1.53	0.73
1:A:139:GLN:HA	1:A:161:GLN:HB2	1.71	0.72
1:A:37:ILE:HG23	1:A:44:ALA:HB2	1.71	0.72
1:A:163:ASN:OD1	1:A:165:GLN:HB3	1.91	0.70
1:A:23:ALA:O	1:A:26:THR:HG22	1.92	0.70
1:A:457:ASP:HA	1:A:461:GLU:HB2	1.74	0.69
1:A:11:LEU:O	1:A:14:GLN:HB2	1.92	0.69
1:A:206:ALA:HA	1:A:258:LEU:HD22	1.75	0.68
1:A:62:GLN:HA	1:A:65:ARG:HD2	1.77	0.67
1:A:9:LEU:HA	1:A:12:LEU:HD12	1.77	0.66
1:A:35:LEU:HD13	1:A:454:GLU:HA	1.76	0.66
1:A:192:ASP:HB3	1:A:282:GLN:HE22	1.62	0.65
1:A:60:LEU:HA	1:A:63:ALA:HB3	1.77	0.65
1:A:60:LEU:HD22	1:A:439:LEU:HD13	1.78	0.65
1:A:155:ILE:HG23	1:A:431:ARG:HD2	1.77	0.65
1:A:288:LEU:HB3	1:A:291:ALA:HB3	1.79	0.65
1:A:362:LYS:HG2	1:A:363:LEU:N	2.12	0.64
1:A:216:ILE:CG2	1:A:231:ALA:HB1	2.26	0.64
1:A:253:ASN:OD1	1:A:255:GLU:HG3	1.95	0.64
1:A:439:LEU:O	1:A:443:VAL:HG23	1.97	0.63
1:A:92:ARG:HG2	1:A:411:ILE:HG21	1.79	0.63
1:A:457:ASP:HB3	1:A:462:VAL:HA	1.81	0.63
1:A:118:ARG:O	1:A:122:ILE:HG13	2.01	0.61
1:A:351:ALA:O	1:A:390:PHE:HB2	2.01	0.60
1:A:222:PHE:HB3	1:A:276:GLU:HB2	1.83	0.60
1:A:3:VAL:O	1:A:6:THR:HG22	2.02	0.59
1:A:53:PHE:HA	1:A:56:ASN:HD22	1.68	0.59
1:A:92:ARG:NH2	1:A:415:LEU:HD12	2.17	0.59
1:A:457:ASP:HB3	1:A:462:VAL:CA	2.33	0.57
1:A:8:SER:O	1:A:12:LEU:HG	2.03	0.57
1:A:49:ILE:HA	1:A:52:ARG:HD2	1.86	0.57
1:A:69:ASP:O	1:A:73:ILE:HG13	2.04	0.57
1:A:147:VAL:HG11	1:A:155:ILE:HD12	1.86	0.57
1:A:469:GLN:O	1:A:473:GLN:HB2	2.06	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:472:GLN:HA	1:A:472:GLN:OE1	2.06	0.55
1:A:140:ASP:HA	1:A:159:LEU:O	2.07	0.55
1:A:362:LYS:HG2	1:A:363:LEU:H	1.71	0.54
1:A:417:GLN:O	1:A:420:THR:HG22	2.07	0.54
1:A:55:ALA:O	1:A:58:LYS:HB2	2.08	0.53
1:A:221:LYS:HD2	1:A:221:LYS:N	2.23	0.53
1:A:309:MET:SD	1:A:324:ALA:HB3	2.49	0.53
1:A:160:LYS:HB2	1:A:421:LEU:HD13	1.91	0.53
1:A:198:ASP:HB3	1:A:255:GLU:HA	1.91	0.52
1:A:124:ARG:O	1:A:128:GLN:HB2	2.09	0.52
1:A:347:THR:HG23	1:A:361:ASN:OD1	2.10	0.51
1:A:353:ASP:H	1:A:357:LYS:NZ	2.07	0.51
1:A:72:SER:HA	1:A:75:GLN:HE21	1.75	0.51
1:A:112:GLN:OE1	1:A:173:ASN:HA	2.10	0.51
1:A:6:THR:O	1:A:9:LEU:HB3	2.11	0.50
1:A:9:LEU:HD13	1:A:10:SER:N	2.26	0.50
1:A:10:SER:O	1:A:13:THR:HG22	2.12	0.50
1:A:7:ASN:HD22	1:A:490:LEU:HD21	1.77	0.50
1:A:2:GLN:OE1	1:A:2:GLN:N	2.45	0.50
1:A:55:ALA:HA	1:A:58:LYS:CD	2.36	0.49
1:A:244:TYR:CE2	1:A:270:LEU:HD22	2.47	0.49
1:A:471:LEU:HD13	1:A:472:GLN:N	2.27	0.49
1:A:181:SER:OG	1:A:310:SER:HB2	2.12	0.49
1:A:350:THR:O	1:A:389:ASN:HA	2.13	0.49
1:A:485:VAL:O	1:A:489:VAL:HG23	2.13	0.49
1:A:223:ASP:HA	1:A:274:ALA:HA	1.95	0.49
1:A:351:ALA:HA	1:A:355:THR:O	2.13	0.48
1:A:482:ALA:O	1:A:486:PRO:HD2	2.13	0.48
1:A:478:VAL:O	1:A:481:GLN:HG2	2.13	0.48
1:A:307:VAL:HG22	1:A:324:ALA:O	2.14	0.48
1:A:24:LEU:O	1:A:28:ILE:HG12	2.14	0.47
1:A:162:ILE:HD11	1:A:421:LEU:CD1	2.44	0.47
1:A:180:VAL:HG22	1:A:311:TYR:CE2	2.50	0.47
1:A:137:LEU:O	1:A:161:GLN:HA	2.13	0.47
1:A:209:LEU:HB2	1:A:214:GLN:HE21	1.79	0.47
1:A:4:ILE:O	1:A:8:SER:HB2	2.15	0.47
1:A:57:ILE:O	1:A:61:THR:HG23	2.14	0.47
1:A:330:ASP:HB3	1:A:362:LYS:HZ2	1.81	0.46
1:A:352:ASP:H	1:A:357:LYS:HZ2	1.63	0.46
1:A:54:THR:HG22	1:A:58:LYS:HE3	1.97	0.46
1:A:88:LEU:O	1:A:91:VAL:HB	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:221:LYS:HB3	1:A:274:ALA:O	2.16	0.46
1:A:155:ILE:CG2	1:A:431:ARG:HD2	2.45	0.46
1:A:20:SER:O	1:A:23:ALA:HB3	2.16	0.46
1:A:338:LYS:HD2	1:A:339:ASP:N	2.25	0.45
1:A:9:LEU:O	1:A:12:LEU:HB2	2.17	0.45
1:A:477:SER:O	1:A:480:ALA:HB3	2.16	0.45
1:A:222:PHE:CZ	1:A:227:GLY:HA2	2.51	0.45
1:A:325:VAL:O	1:A:332:TYR:HD1	2.00	0.45
1:A:48:ALA:O	1:A:52:ARG:HG3	2.17	0.45
1:A:24:LEU:O	1:A:27:ALA:HB3	2.17	0.45
1:A:179:LYS:HB3	1:A:312:THR:HB	1.98	0.45
1:A:16:ASN:O	1:A:19:LYS:HB3	2.16	0.44
1:A:57:ILE:HA	1:A:60:LEU:HB2	1.98	0.44
1:A:18:ASN:O	1:A:21:GLN:HB3	2.17	0.44
1:A:27:ALA:O	1:A:30:ARG:HB2	2.17	0.44
1:A:348:LYS:NZ	1:A:348:LYS:HB2	2.32	0.44
1:A:365:GLY:HA3	1:A:370:THR:HB	2.00	0.44
1:A:47:GLN:NE2	1:A:47:GLN:HA	2.32	0.44
1:A:73:ILE:HG12	1:A:131:PHE:CD2	2.52	0.44
1:A:163:ASN:HD21	1:A:166:THR:HG23	1.82	0.43
1:A:8:SER:O	1:A:12:LEU:N	2.50	0.43
1:A:447:THR:HA	1:A:450:ARG:HE	1.83	0.43
1:A:65:ARG:O	1:A:68:ASN:HB2	2.18	0.43
1:A:195:ILE:HB	1:A:281:VAL:HB	2.01	0.43
1:A:233:VAL:HG12	1:A:235:VAL:HG23	2.00	0.43
1:A:81:LEU:HD23	1:A:84:ILE:HD12	2.00	0.42
1:A:49:ILE:O	1:A:52:ARG:HB2	2.19	0.42
1:A:426:ALA:O	1:A:429:GLN:HB2	2.19	0.42
1:A:105:GLN:O	1:A:108:LEU:HB2	2.20	0.42
1:A:294:ALA:O	1:A:297:ALA:HB3	2.20	0.42
1:A:290:GLU:O	1:A:291:ALA:C	2.58	0.42
1:A:57:ILE:HA	1:A:60:LEU:HD12	2.02	0.42
1:A:394:PRO:HG2	1:A:395:ASP:H	1.85	0.42
1:A:415:LEU:HD23	1:A:415:LEU:HA	1.91	0.41
1:A:325:VAL:HG23	1:A:334:ALA:HB2	2.03	0.41
1:A:15:ASN:O	1:A:18:ASN:HB2	2.21	0.41
1:A:485:VAL:HB	1:A:486:PRO:CD	2.51	0.41
1:A:439:LEU:HA	1:A:442:THR:OG1	2.20	0.41
1:A:53:PHE:HA	1:A:56:ASN:ND2	2.33	0.41
1:A:107:ASP:O	1:A:111:ILE:HG13	2.21	0.41
1:A:330:ASP:HB3	1:A:362:LYS:NZ	2.36	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:19:LYS:O	1:A:22:SER:HB3	2.20	0.41
1:A:160:LYS:HG3	1:A:421:LEU:CD2	2.43	0.41
1:A:180:VAL:HG22	1:A:311:TYR:CD2	2.56	0.41
1:A:191:ALA:O	1:A:283:VAL:HG12	2.21	0.41
1:A:174:VAL:HA	1:A:403:THR:HG23	2.03	0.41
1:A:118:ARG:HD3	1:A:118:ARG:HA	1.66	0.41
1:A:38:ASN:OD1	1:A:39:SER:N	2.54	0.40
1:A:12:LEU:HD23	1:A:12:LEU:HA	1.96	0.40
1:A:60:LEU:HA	1:A:63:ALA:CB	2.49	0.40
1:A:95:ALA:O	1:A:98:SER:OG	2.38	0.40
1:A:56:ASN:O	1:A:60:LEU:HG	2.22	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 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	492/494 (100%)	426 (87%)	52 (11%)	14 (3%)	6 47

All (14) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	355	THR
1	A	33	SER
1	A	314	ASN
1	A	32	SER
1	A	260	GLY
1	A	285	ASN
1	A	290	GLU
1	A	351	ALA
1	A	394	PRO
1	A	101	SER

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Mol	Chain	Res	Type
1	A	224	ASP
1	A	251	LYS
1	A	493	LEU
1	A	99	ALA

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	390/390 (100%)	359 (92%)	31 (8%)	15	54

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	9	LEU
1	A	16	ASN
1	A	17	LEU
1	A	19	LYS
1	A	26	THR
1	A	29	GLU
1	A	37	ILE
1	A	43	ASP
1	A	118	ARG
1	A	139	GLN
1	A	165	GLN
1	A	171	THR
1	A	194	THR
1	A	200	SER
1	A	205	SER
1	A	212	THR
1	A	214	GLN
1	A	239	THR
1	A	242	ASP
1	A	248	SER
1	A	338	LYS
1	A	343	SER

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Mol	Chain	Res	Type
1	A	348	LYS
1	A	386	GLU
1	A	412	ASP
1	A	432	PHE
1	A	438	ASN
1	A	442	THR
1	A	452	ARG
1	A	471	LEU
1	A	473	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	7	ASN
1	A	56	ASN
1	A	62	GLN
1	A	75	GLN
1	A	89	GLN
1	A	117	GLN
1	A	120	ASN
1	A	282	GLN
1	A	388	HIS
1	A	433	ASN
1	A	464	ASN
1	A	481	GLN
1	A	487	GLN

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 [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.