



wwPDB EM Map/Model Validation Report ⓘ

Apr 10, 2016 – 01:56 PM BST

PDB ID : 4CYL
EMDB ID: : EMD-2530
Title : Tomographic subvolume average of EFF-1 fusogen on extracellular vesicles
Authors : Zeev-Ben-Mordehai, T.; Vasishtan, D.; Siebert, C.A.; Grunewald, K.
Deposited on : 2014-04-13
Resolution : 22.20 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

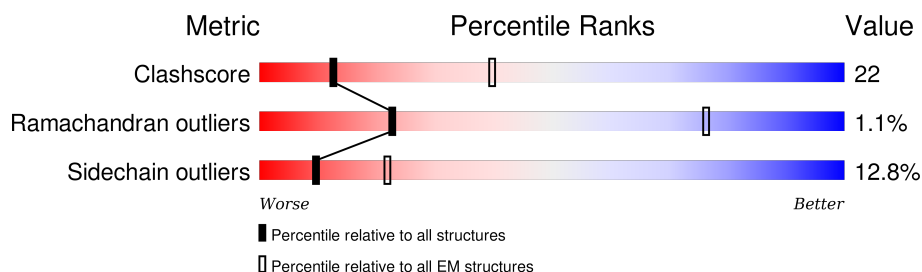
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 22.20 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	658	<div>48% 18% • 29%</div>

2 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 3644 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.

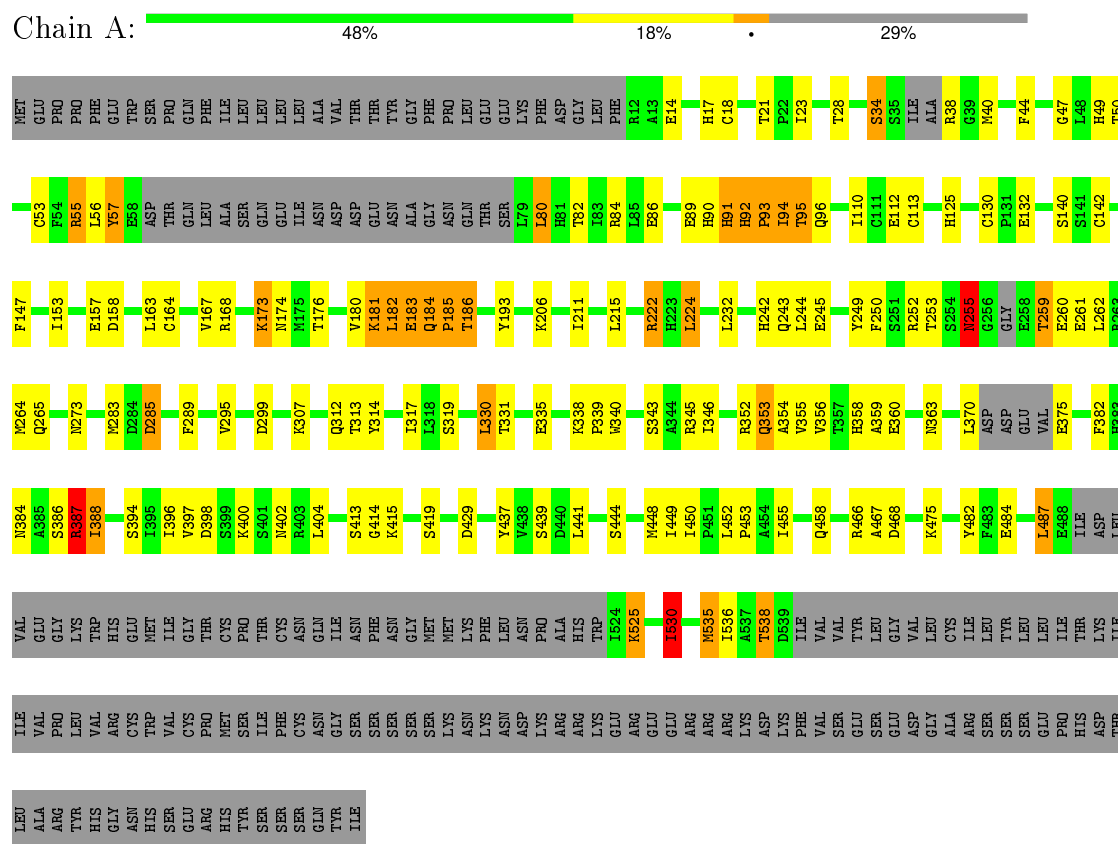
- Molecule 1 is a protein called EFF-1A.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	466	Total	C	N	O	S	0	5
			3644	2277	650	690	27		

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: EFF-1A



4 Experimental information

Property	Value	Source
Reconstruction method	TOMOGRAPHY	Depositor
Imposed symmetry	POINT, Not provided	Depositor
Number of images	Not provided	Depositor
Resolution determination method	Not provided	Depositor
CTF correction method	Not provided	Depositor
Microscope	FEI TECNAI F30	Depositor
Voltage (kV)	200	Depositor
Electron dose ($e^-/\text{\AA}^2$)	80	Depositor
Minimum defocus (nm)	2000	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	95000	Depositor
Image detector	GATAN ULTRASCAN 4000 (4K X 4K)	Depositor

5 Model quality

5.1 Standard geometry

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	0.55	0/3720	1.72	10/5027 (0.2%)

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	10

There are no bond length outliers.

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	34	SER	O-C-N	-64.72	19.14	122.70
1	A	57	TYR	O-C-N	-61.84	23.75	122.70
1	A	487	LEU	O-C-N	-50.81	41.41	122.70
1	A	538	THR	O-C-N	-21.48	88.33	122.70
1	A	255	ASN	O-C-N	-12.51	101.94	123.20
1	A	387	ARG	NE-CZ-NH1	-8.06	116.27	120.30
1	A	387	ARG	CD-NE-CZ	-5.87	115.38	123.60
1	A	186	THR	C-N-CA	-5.57	107.77	121.70
1	A	186	THR	CA-CB-CG2	-5.06	105.32	112.40
1	A	80	LEU	CA-CB-CG	5.03	126.88	115.30

There are no chirality outliers.

All (10) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	181	LYS	Peptide
1	A	185	PRO	Peptide
1	A	255	ASN	Mainchain

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Mol	Chain	Res	Type	Group
1	A	34	SER	Mainchain
1	A	487	LEU	Mainchain
1	A	538	THR	Mainchain
1	A	57	TYR	Mainchain
1	A	93	PRO	Peptide
1	A	94	ILE	Peptide
1	A	95	THR	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	3644	0	3534	157	0
All	All	3644	0	3534	157	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 22.

All (157) 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:182:LEU:HD11	1:A:262:LEU:HD13	1.28	1.12
1:A:94:ILE:HD11	1:A:181:LYS:HD3	1.13	1.09
1:A:387:ARG:HD3	1:A:413:SER:HB3	1.22	1.09
1:A:92:HIS:HA	1:A:183:GLU:HA	1.31	1.07
1:A:250:PHE:HZ	1:A:330:LEU:HD21	1.19	1.05
1:A:92:HIS:HB3	1:A:354:ALA:H	1.23	0.99
1:A:94:ILE:HG23	1:A:184:GLN:HG3	1.44	0.99
1:A:359:ALA:HB1	1:A:449:ILE:HD13	1.43	0.97
1:A:250:PHE:CZ	1:A:330:LEU:HD21	1.99	0.96
1:A:50:THR:CG2	1:A:437:TYR:HB2	1.96	0.95
1:A:92:HIS:HB2	1:A:354:ALA:HB3	1.47	0.94
1:A:359:ALA:HB1	1:A:449:ILE:CD1	1.98	0.94
1:A:94:ILE:HD11	1:A:181:LYS:CD	1.97	0.93
1:A:183:GLU:HB2	1:A:244:LEU:HD13	1.51	0.93
1:A:387:ARG:CD	1:A:413:SER:HB3	1.98	0.92

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:259:THR:CB	1:A:346:ILE:HB	1.98	0.92
1:A:182:LEU:HD11	1:A:262:LEU:CD1	1.99	0.92
1:A:50:THR:HG22	1:A:437:TYR:HB2	1.52	0.89
1:A:182:LEU:HB2	1:A:249:TYR:HD2	1.38	0.87
1:A:259:THR:HB	1:A:346:ILE:HB	1.56	0.87
1:A:182:LEU:HD12	1:A:249:TYR:CD2	2.14	0.83
1:A:182:LEU:HD12	1:A:249:TYR:CG	2.15	0.82
1:A:185:PRO:HG3	1:A:244:LEU:HG	1.61	0.82
1:A:92:HIS:CA	1:A:183:GLU:HA	2.08	0.81
1:A:94:ILE:CD1	1:A:181:LYS:HD3	2.07	0.78
1:A:90:HIS:CD2	1:A:185:PRO:HB3	2.18	0.78
1:A:17:HIS:CE1	1:A:414:GLY:HA2	2.17	0.78
1:A:89:GLU:HG2	1:A:355:VAL:CG1	2.13	0.78
1:A:90:HIS:HB3	1:A:244:LEU:HD11	1.65	0.77
1:A:359:ALA:HB1	1:A:449:ILE:CG1	2.16	0.76
1:A:387:ARG:HD3	1:A:413:SER:CB	2.10	0.75
1:A:330:LEU:HD23	1:A:331:THR:H	1.49	0.75
1:A:92:HIS:HA	1:A:183:GLU:CA	2.14	0.75
1:A:92:HIS:CB	1:A:354:ALA:HB3	2.16	0.75
1:A:94:ILE:HG12	1:A:184:GLN:OE1	1.87	0.74
1:A:339:PRO:HD2	1:A:398:ASP:CB	2.17	0.74
1:A:183:GLU:CD	1:A:356:VAL:HG21	2.10	0.72
1:A:182:LEU:HB2	1:A:249:TYR:CD2	2.23	0.70
1:A:93:PRO:HG3	1:A:352:ARG:O	1.91	0.70
1:A:339:PRO:HD2	1:A:398:ASP:HB2	1.72	0.70
1:A:50:THR:HG21	1:A:437:TYR:HB2	1.71	0.69
1:A:264:MET:O	1:A:331:THR:HG21	1.94	0.67
1:A:95:THR:HG23	1:A:96:GLN:N	2.09	0.67
1:A:92:HIS:CB	1:A:354:ALA:H	2.04	0.66
1:A:338:LYS:HZ1	1:A:400:LYS:HE3	1.61	0.66
1:A:93:PRO:HG2	1:A:353:GLN:HE21	1.61	0.65
1:A:50:THR:HA	1:A:439:SER:OG	1.97	0.65
1:A:259:THR:CG2	1:A:346:ILE:HB	2.26	0.65
1:A:89:GLU:HG2	1:A:355:VAL:HG13	1.79	0.63
1:A:330:LEU:HD23	1:A:331:THR:N	2.13	0.63
1:A:259:THR:HB	1:A:346:ILE:HD13	1.80	0.62
1:A:185:PRO:HG3	1:A:244:LEU:CG	2.29	0.62
1:A:338:LYS:NZ	1:A:400:LYS:HE3	2.15	0.61
1:A:18:CYS:HB2	1:A:384:ASN:OD1	1.99	0.61
1:A:360:GLU:HG3	1:A:449:ILE:H	1.66	0.60
1:A:185:PRO:HG3	1:A:244:LEU:CD1	2.32	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:183:GLU:OE1	1:A:244:LEU:HD13	2.03	0.59
1:A:260:GLU:HG2	1:A:261:GLU:H	1.66	0.59
1:A:183:GLU:OE1	1:A:356:VAL:HG21	2.04	0.58
1:A:92:HIS:HB3	1:A:354:ALA:N	2.06	0.56
1:A:259:THR:HG21	1:A:346:ILE:HB	1.87	0.56
1:A:359:ALA:HB1	1:A:449:ILE:HG12	1.86	0.56
1:A:339:PRO:HG2	1:A:396:ILE:HG21	1.86	0.56
1:A:359:ALA:CB	1:A:449:ILE:HG12	2.36	0.55
1:A:260:GLU:HA	1:A:345:ARG:CZ	2.37	0.55
1:A:260:GLU:HA	1:A:345:ARG:NH2	2.21	0.55
1:A:95:THR:HG23	1:A:96:GLN:HG3	1.89	0.55
1:A:265:GLN:OE1	1:A:330:LEU:HD23	2.07	0.54
1:A:339:PRO:CG	1:A:396:ILE:HG21	2.38	0.53
1:A:388:ILE:HG22	1:A:467:ALA:HB2	1.90	0.53
1:A:91:HIS:H	1:A:186:THR:H	1.55	0.53
1:A:386:SER:HA	1:A:413:SER:O	2.07	0.53
1:A:182:LEU:HG	1:A:249:TYR:HB2	1.90	0.53
1:A:314:TYR:HE2	1:A:530:ILE:HG22	1.73	0.53
1:A:360:GLU:HG3	1:A:449:ILE:O	2.08	0.52
1:A:182:LEU:CB	1:A:249:TYR:CD2	2.92	0.52
1:A:339:PRO:HD2	1:A:398:ASP:HB3	1.90	0.52
1:A:224:LEU:HD22	1:A:232:LEU:HB2	1.91	0.52
1:A:339:PRO:HG2	1:A:396:ILE:CG2	2.40	0.52
1:A:53:CYS:SG	1:A:82:THR:HG22	2.49	0.52
1:A:176:THR:HG22	1:A:253:THR:OG1	2.10	0.52
1:A:17:HIS:CG	1:A:414:GLY:HA2	2.45	0.51
1:A:312:GLN:O	1:A:530:ILE:HG23	2.10	0.51
1:A:261:GLU:OE1	1:A:335:GLU:HG2	2.11	0.51
1:A:92:HIS:ND1	1:A:182:LEU:HD23	2.24	0.51
1:A:49:HIS:HA	1:A:84:ARG:NH1	2.26	0.51
1:A:17:HIS:CD2	1:A:414:GLY:HA2	2.46	0.51
1:A:180:VAL:HG23	1:A:182:LEU:HG	1.93	0.51
1:A:386:SER:HB3	1:A:468:ASP:H	1.76	0.51
1:A:386:SER:HB2	1:A:415:LYS:N	2.26	0.50
1:A:147:PHE:HB2	1:A:163:LEU:HB3	1.94	0.50
1:A:14:GLU:OE1	1:A:441:LEU:HD23	2.12	0.50
1:A:94:ILE:HG23	1:A:184:GLN:CG	2.30	0.50
1:A:259:THR:HB	1:A:346:ILE:CD1	2.42	0.49
1:A:453:PRO:HG2	1:A:455:ILE:HG22	1.94	0.49
1:A:314:TYR:CE2	1:A:530:ILE:HG22	2.48	0.49
1:A:182:LEU:HD22	1:A:183:GLU:H	1.76	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:92:HIS:CB	1:A:93:PRO:HD3	2.42	0.49
1:A:340:TRP:HB3	1:A:402:ASN:ND2	2.28	0.49
1:A:47:GLY:HA2	1:A:363:ASN:OD1	2.13	0.49
1:A:397:VAL:HB	1:A:484:GLU:HG3	1.94	0.48
1:A:90:HIS:HA	1:A:186:THR:O	2.13	0.48
1:A:339:PRO:HG2	1:A:398:ASP:HB3	1.94	0.48
1:A:182:LEU:HD22	1:A:183:GLU:N	2.28	0.48
1:A:92:HIS:O	1:A:183:GLU:HA	2.13	0.48
1:A:17:HIS:NE2	1:A:414:GLY:HA2	2.28	0.48
1:A:17:HIS:CE1	1:A:414:GLY:CA	2.95	0.48
1:A:17:HIS:ND1	1:A:414:GLY:HA2	2.29	0.48
1:A:93:PRO:HG2	1:A:353:GLN:NE2	2.29	0.47
1:A:317:ILE:HG23	1:A:525:LYS:HA	1.95	0.47
1:A:89:GLU:CG	1:A:355:VAL:HG13	2.44	0.47
1:A:17:HIS:NE2	1:A:414:GLY:CA	2.78	0.47
1:A:142:CYS:HB3	1:A:168:ARG:HG3	1.97	0.47
1:A:535:MET:N	1:A:535:MET:SD	2.79	0.47
1:A:193:TYR:CD1	1:A:224:LEU:HD12	2.51	0.46
1:A:242:HIS:HB2	1:A:340:TRP:CE3	2.51	0.46
1:A:92:HIS:CG	1:A:354:ALA:HB3	2.51	0.46
1:A:245:GLU:HB2	1:A:400:LYS:NZ	2.30	0.46
1:A:182:LEU:HD22	1:A:183:GLU:HG3	1.97	0.46
1:A:359:ALA:CB	1:A:449:ILE:CG1	2.90	0.45
1:A:95:THR:HG23	1:A:96:GLN:CG	2.46	0.45
1:A:55:ARG:HB2	1:A:382:PHE:HE2	1.82	0.45
1:A:185:PRO:CD	1:A:244:LEU:HD12	2.47	0.45
1:A:182:LEU:HD13	1:A:183:GLU:HG3	1.99	0.44
1:A:84:ARG:HE	1:A:439:SER:CB	2.30	0.44
1:A:92:HIS:HB3	1:A:93:PRO:HD3	2.00	0.44
1:A:17:HIS:CD2	1:A:414:GLY:CA	3.00	0.44
1:A:283:MET:HB2	1:A:289:PHE:CE1	2.52	0.44
1:A:335:GLU:N	1:A:335:GLU:OE1	2.45	0.44
1:A:183:GLU:OE1	1:A:244:LEU:HD22	2.18	0.44
1:A:458:GLN:HG2	1:A:482:TYR:CE1	2.53	0.44
1:A:125:HIS:CD2	1:A:164:CYS:HB3	2.53	0.44
1:A:330:LEU:HD22	1:A:331:THR:O	2.18	0.44
1:A:535:MET:HG2	1:A:536:ILE:HG12	1.99	0.44
1:A:245:GLU:HB3	1:A:249:TYR:OH	2.17	0.43
1:A:14:GLU:CD	1:A:441:LEU:CD2	2.86	0.43
1:A:173:LYS:HD2	1:A:173:LYS:N	2.26	0.43
1:A:185:PRO:HD3	1:A:244:LEU:HD12	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:89:GLU:CG	1:A:355:VAL:CG1	2.92	0.43
1:A:95:THR:HG23	1:A:96:GLN:CA	2.47	0.43
1:A:307:LYS:HD2	1:A:313:THR:HB	2.01	0.43
1:A:50:THR:HG22	1:A:437:TYR:CB	2.37	0.42
1:A:387:ARG:NE	1:A:413:SER:HB3	2.34	0.42
1:A:211:ILE:HG23	1:A:222:ARG:HD2	2.01	0.42
1:A:360:GLU:HG3	1:A:449:ILE:N	2.33	0.42
1:A:182:LEU:CD1	1:A:249:TYR:CD2	2.96	0.42
1:A:95:THR:CG2	1:A:96:GLN:N	2.81	0.42
1:A:92:HIS:CE1	1:A:182:LEU:HD23	2.55	0.41
1:A:183:GLU:OE1	1:A:244:LEU:HB3	2.21	0.41
1:A:242:HIS:CG	1:A:340:TRP:HB2	2.55	0.41
1:A:243:GLN:O	1:A:340:TRP:CH2	2.74	0.41
1:A:242:HIS:O	1:A:358:HIS:HE1	2.03	0.41
1:A:184:GLN:HA	1:A:185:PRO:HD3	1.74	0.41
1:A:359:ALA:O	1:A:360:GLU:HG2	2.21	0.41
1:A:448:MET:HG3	1:A:450:ILE:HD11	2.01	0.41
1:A:92:HIS:HA	1:A:183:GLU:CB	2.51	0.40
1:A:23:ILE:HD13	1:A:44:PHE:HB3	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 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	454/658 (69%)	412 (91%)	37 (8%)	5 (1%)	17 63

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	530	ILE
1	A	157	GLU

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Mol	Chain	Res	Type
1	A	255	ASN
1	A	285	ASP
1	A	295	VAL

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	406/584 (70%)	354 (87%)	52 (13%)	5	29

All (52) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	THR
1	A	28	THR
1	A	38	ARG
1	A	40	MET
1	A	55	ARG
1	A	56	LEU
1	A	80	LEU
1	A	86	GLU
1	A	91	HIS
1	A	92	HIS
1	A	110	ILE
1	A	112	GLU
1	A	113	CYS
1	A	130	CYS
1	A	132	GLU
1	A	140	SER
1	A	153	ILE
1	A	158	ASP
1	A	167	VAL
1	A	173	LYS
1	A	174	ASN
1	A	182	LEU
1	A	183	GLU

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Mol	Chain	Res	Type
1	A	184	GLN
1	A	206	LYS
1	A	215	LEU
1	A	222	ARG
1	A	224	LEU
1	A	252	ARG
1	A	259	THR
1	A	273	ASN
1	A	285	ASP
1	A	299	ASP
1	A	319	SER
1	A	330	LEU
1	A	343	SER
1	A	353	GLN
1	A	370	LEU
1	A	375	GLU
1	A	387	ARG
1	A	388	ILE
1	A	394	SER
1	A	404	LEU
1	A	419	SER
1	A	429	ASP
1	A	444	SER
1	A	452	LEU
1	A	466	ARG
1	A	475	LYS
1	A	525	LYS
1	A	530	ILE
1	A	535	MET

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	353	GLN
1	A	402	ASN

5.3.3 RNA ⓘ

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 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.