



## Full wwPDB EM Validation Report ⓘ

Oct 22, 2024 – 12:33 AM JST

PDB ID : 8XZG  
EMDB ID : EMD-38795  
Title : Cryo-EM structure of the [Pyr1]-apelin-13-bound human APLNR-Gi complex  
Authors : Wang, W.; Ji, S.; Zhang, Y.  
Deposited on : 2024-01-21  
Resolution : 3.20 Å (reported)

This is a Full wwPDB EM Validation Report for a publicly released PDB entry.

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

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>

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:

EMDB validation analysis : **FAILED**  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
MolProbity : 4.02b-467  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
MapQ : **FAILED**  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

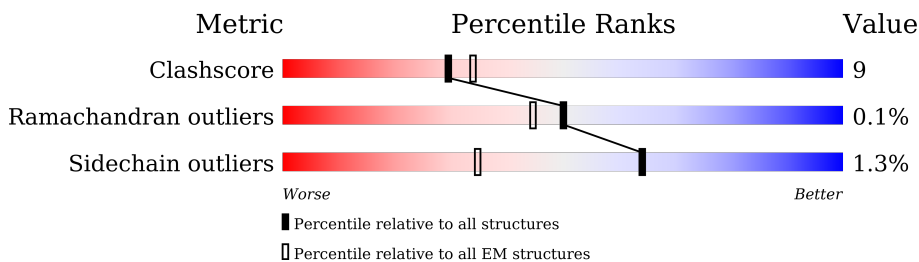
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*

The reported resolution of this entry is 3.20 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	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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  $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	354	
2	B	339	
3	G	71	
4	L	13	
5	R	380	

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 7172 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 Guanine nucleotide-binding protein G(i) subunit alpha-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	217	1737	1106	290	327	14	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	47	ASN	SER	conflict	UNP P63096
A	203	ALA	GLY	conflict	UNP P63096
A	245	ALA	GLU	conflict	UNP P63096
A	326	SER	ALA	conflict	UNP P63096

- Molecule 2 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	331	2528	1559	457	493	19	0	0

- Molecule 3 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	G	58	444	277	79	85	3	0	0

- Molecule 4 is a protein called Apelin-13.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	L	13	107	69	22	15	1	0	0

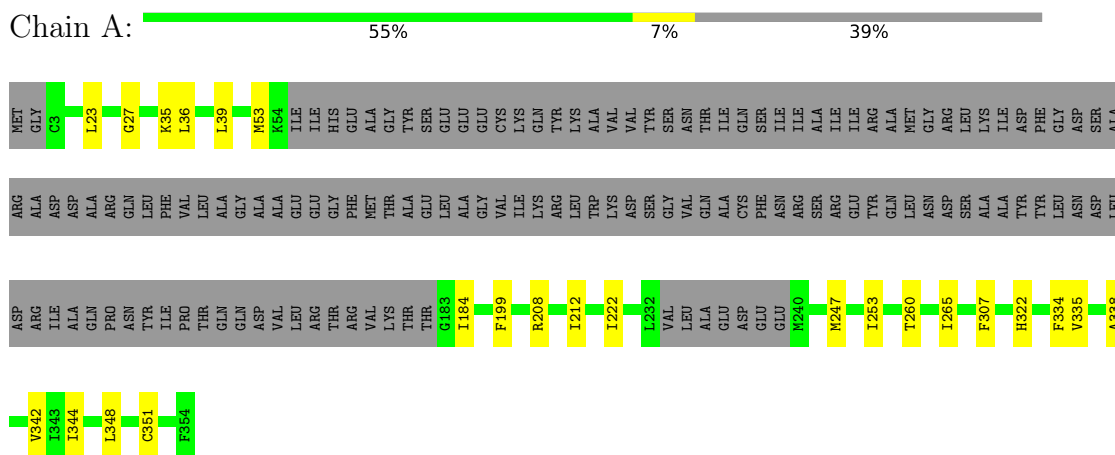
- Molecule 5 is a protein called Apelin receptor.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	R	300	2356	1561	374	397	24	0	0

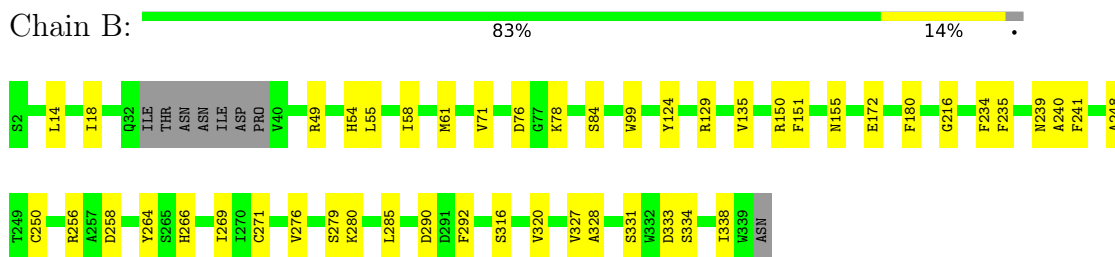
### 3 Residue-property plots [i](#)

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. 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.

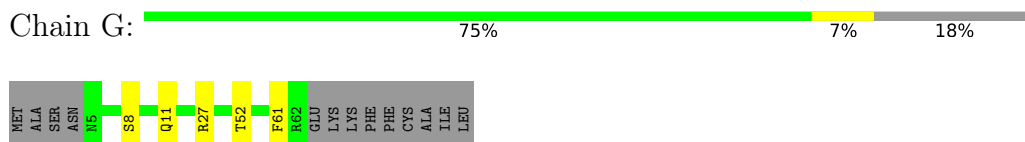
- Molecule 1: Guanine nucleotide-binding protein G(i) subunit alpha-1



- Molecule 2: Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1



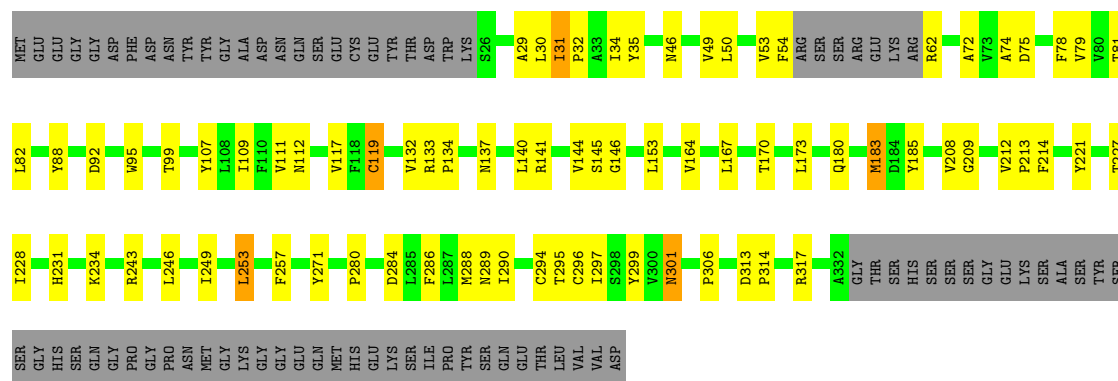
- Molecule 3: Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2



- Molecule 4: Apelin-13



• Molecule 5: Apelin receptor



## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	201936	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	62.4	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (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: PCA

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	0.35	0/1765	0.46	0/2367
2	B	0.46	0/2572	0.56	0/3485
3	G	0.29	0/450	0.42	0/608
4	L	0.28	0/104	0.39	0/140
5	R	0.44	0/2420	0.50	0/3302
All	All	0.42	0/7311	0.51	0/9902

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 [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	1737	0	1726	16	0
2	B	2528	0	2422	32	0
3	G	444	0	454	4	0
4	L	107	0	110	7	0
5	R	2356	0	2375	81	0
All	All	7172	0	7087	128	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 9.



All (128) 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)
5:R:295:THR:O	5:R:299:TYR:CE1	2.21	0.92
5:R:35:TYR:CD2	5:R:82:LEU:HD11	2.11	0.84
5:R:295:THR:O	5:R:299:TYR:HE1	1.59	0.82
5:R:46:ASN:ND2	5:R:75:ASP:OD1	2.17	0.77
2:B:271:CYS:HB2	2:B:290:ASP:HB2	1.68	0.76
5:R:35:TYR:HD2	5:R:82:LEU:HD11	1.49	0.76
5:R:78:PHE:HE2	5:R:299:TYR:CD2	2.04	0.76
2:B:320:VAL:HG22	2:B:327:VAL:HG22	1.68	0.75
2:B:264:TYR:CE2	2:B:285:LEU:HD23	2.24	0.73
5:R:31:ILE:O	5:R:35:TYR:HD1	1.73	0.72
2:B:250:CYS:HB2	2:B:264:TYR:HD2	1.54	0.72
5:R:295:THR:O	5:R:299:TYR:CD1	2.44	0.71
5:R:30:LEU:O	5:R:34:ILE:HG12	1.92	0.68
2:B:49:ARG:NH2	3:G:61:PHE:O	2.28	0.67
5:R:46:ASN:CG	5:R:75:ASP:HB2	2.17	0.65
2:B:250:CYS:CB	2:B:264:TYR:HD2	2.11	0.64
1:A:265:ILE:HG23	1:A:334:PHE:HE2	1.62	0.64
5:R:31:ILE:O	5:R:35:TYR:CD1	2.52	0.61
5:R:31:ILE:N	5:R:32:PRO:HD2	2.16	0.60
5:R:53:VAL:HG13	5:R:53:VAL:O	2.01	0.59
5:R:249:ILE:O	5:R:253:LEU:HD12	2.01	0.59
5:R:271:TYR:CE1	5:R:284:ASP:OD1	2.56	0.59
2:B:276:VAL:HG13	2:B:285:LEU:HD11	1.84	0.59
2:B:264:TYR:HE2	2:B:285:LEU:HD23	1.66	0.58
5:R:286:PHE:O	5:R:290:ILE:HG22	2.03	0.58
2:B:54:HIS:C	2:B:55:LEU:HD12	2.24	0.58
2:B:180:PHE:CE2	2:B:216:GLY:HA2	2.39	0.57
5:R:271:TYR:CD1	5:R:288:MET:HE2	2.39	0.57
5:R:46:ASN:OD1	5:R:75:ASP:CB	2.53	0.57
1:A:344:ILE:HG13	5:R:134:PRO:HG3	1.87	0.56
2:B:248:ALA:HB1	2:B:269:ILE:HG22	1.87	0.56
5:R:107:TYR:O	5:R:111:VAL:HG12	2.06	0.56
5:R:31:ILE:HG23	5:R:35:TYR:CE1	2.41	0.55
5:R:145:SER:OG	5:R:146:GLY:N	2.39	0.55
5:R:35:TYR:CE1	5:R:296:CYS:SG	3.00	0.55
5:R:35:TYR:CE2	5:R:82:LEU:HD11	2.41	0.55
5:R:212:VAL:HB	5:R:213:PRO:HD3	1.89	0.55
2:B:235:PHE:HB2	2:B:240:ALA:HB3	1.90	0.54
5:R:78:PHE:CE2	5:R:299:TYR:CE2	2.96	0.54
5:R:31:ILE:N	5:R:31:ILE:HD13	2.23	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:R:289:ASN:N	5:R:289:ASN:HD22	2.07	0.53
2:B:266:HIS:HB3	2:B:269:ILE:HD12	1.91	0.53
5:R:78:PHE:HE2	5:R:299:TYR:CE2	2.28	0.52
5:R:119:CYS:HA	5:R:153:LEU:HD22	1.92	0.52
5:R:31:ILE:HG23	5:R:35:TYR:HE1	1.75	0.52
5:R:35:TYR:HD2	5:R:82:LEU:CD1	2.19	0.52
5:R:31:ILE:N	5:R:31:ILE:CD1	2.73	0.51
5:R:74:ALA:O	5:R:78:PHE:HB2	2.10	0.51
5:R:167:LEU:HD13	5:R:185:TYR:HA	1.92	0.51
1:A:208:ARG:O	1:A:212:ILE:HB	2.11	0.51
1:A:322:HIS:CB	1:A:334:PHE:CE1	2.94	0.51
5:R:234:LYS:HB2	5:R:243:ARG:NH1	2.26	0.51
5:R:271:TYR:CE1	5:R:288:MET:CE	2.94	0.50
5:R:119:CYS:SG	5:R:153:LEU:HD21	2.52	0.50
5:R:227:THR:HG23	5:R:231:HIS:HD2	1.76	0.50
1:A:338:ALA:O	1:A:342:VAL:HG23	2.11	0.50
5:R:99:THR:HG23	5:R:170:THR:HB	1.93	0.50
1:A:53:MET:HE1	1:A:335:VAL:HG21	1.93	0.50
5:R:228:ILE:HD13	5:R:246:LEU:HD23	1.92	0.49
5:R:133:ARG:O	5:R:137:ASN:HB2	2.12	0.49
5:R:78:PHE:CE2	5:R:299:TYR:CD2	2.94	0.49
2:B:331:SER:OG	2:B:333:ASP:OD1	2.31	0.49
5:R:50:LEU:O	5:R:54:PHE:HD1	1.96	0.49
5:R:117:VAL:HG11	5:R:209:GLY:O	2.13	0.48
2:B:14:LEU:O	2:B:18:ILE:HG12	2.14	0.48
1:A:184:ILE:HG21	2:B:99:TRP:CD1	2.48	0.48
1:A:27:GLY:HA3	2:B:55:LEU:CD2	2.43	0.48
5:R:271:TYR:HE1	5:R:284:ASP:OD1	1.96	0.48
5:R:35:TYR:HE1	5:R:296:CYS:SG	2.36	0.48
5:R:46:ASN:OD1	5:R:75:ASP:HB3	2.13	0.47
5:R:29:ALA:O	5:R:32:PRO:HG2	2.13	0.47
5:R:271:TYR:CE1	5:R:288:MET:HE2	2.49	0.47
1:A:23:LEU:HD22	2:B:78:LYS:HD3	1.96	0.47
5:R:49:VAL:HG21	5:R:306:PRO:HB3	1.97	0.47
5:R:50:LEU:O	5:R:54:PHE:CD1	2.68	0.47
5:R:75:ASP:O	5:R:79:VAL:HG22	2.15	0.47
5:R:46:ASN:CG	5:R:75:ASP:CB	2.82	0.46
5:R:313:ASP:OD1	5:R:313:ASP:N	2.47	0.46
4:L:10:PRO:HB2	5:R:109:ILE:HG21	1.96	0.46
3:G:8:SER:O	3:G:11:GLN:HG3	2.16	0.45
5:R:294:CYS:O	5:R:297:ILE:HG22	2.17	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:R:221:TYR:HD1	5:R:221:TYR:HA	1.65	0.45
1:A:322:HIS:CB	1:A:334:PHE:CD1	3.00	0.45
5:R:173:LEU:HD23	5:R:180:GLN:HG2	1.98	0.45
2:B:58:ILE:O	2:B:316:SER:OG	2.33	0.44
5:R:88:TYR:CE1	5:R:95:TRP:HB2	2.52	0.44
1:A:39:LEU:HD21	1:A:253:ILE:HG13	2.00	0.44
4:L:5:LEU:H	4:L:5:LEU:HD23	1.83	0.43
4:L:13:PHE:HE1	5:R:183:MET:HE1	1.82	0.43
5:R:140:LEU:O	5:R:144:VAL:HG22	2.18	0.43
2:B:333:ASP:O	2:B:334:SER:OG	2.29	0.43
5:R:314:PRO:HA	5:R:317:ARG:HD2	2.00	0.43
2:B:61:MET:HE1	2:B:328:ALA:O	2.18	0.43
4:L:5:LEU:HA	4:L:8:LYS:NZ	2.33	0.43
5:R:46:ASN:HD22	5:R:72:ALA:HA	1.84	0.43
3:G:52:THR:O	3:G:52:THR:OG1	2.34	0.42
4:L:10:PRO:HB2	5:R:109:ILE:CD1	2.48	0.42
1:A:351:CYS:SG	5:R:141:ARG:NH2	2.92	0.42
2:B:129:ARG:O	2:B:129:ARG:NH1	2.52	0.42
2:B:279:SER:OG	2:B:280:LYS:N	2.52	0.42
1:A:35:LYS:HB3	1:A:199:PHE:CE1	2.54	0.42
5:R:88:TYR:C	5:R:88:TYR:CD2	2.93	0.42
5:R:132:VAL:HG12	5:R:133:ARG:HG2	2.01	0.42
5:R:208:VAL:O	5:R:208:VAL:HG22	2.19	0.42
1:A:36:LEU:HD13	1:A:222:ILE:HD11	2.02	0.42
4:L:13:PHE:HE1	5:R:183:MET:CE	2.32	0.42
5:R:31:ILE:N	5:R:32:PRO:CD	2.82	0.42
1:A:247:MET:HG2	1:A:307:PHE:CE2	2.55	0.42
5:R:50:LEU:HG	5:R:54:PHE:HE1	1.85	0.42
5:R:78:PHE:HD1	5:R:112:ASN:HB3	1.84	0.41
5:R:301:ASN:C	5:R:301:ASN:ND2	2.73	0.41
2:B:124:TYR:CE2	2:B:135:VAL:HG22	2.56	0.41
5:R:214:PHE:HD1	5:R:257:PHE:CD1	2.39	0.41
2:B:258:ASP:HB3	3:G:27:ARG:HE	1.86	0.41
1:A:348:LEU:HD23	1:A:348:LEU:HA	1.91	0.41
2:B:241:PHE:N	2:B:241:PHE:CD1	2.88	0.41
2:B:292:PHE:CD1	2:B:292:PHE:N	2.88	0.41
5:R:107:TYR:HA	5:R:164:VAL:HG11	2.02	0.41
2:B:84:SER:OG	2:B:338:ILE:CD1	2.69	0.40
5:R:271:TYR:CZ	5:R:288:MET:HE3	2.56	0.40
2:B:155:ASN:HD21	2:B:172:GLU:HB2	1.85	0.40
2:B:61:MET:HA	2:B:71:VAL:O	2.21	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:150:ARG:HA	2:B:150:ARG:HD3	1.87	0.40
4:L:10:PRO:CB	5:R:109:ILE:HD12	2.51	0.40
5:R:81:THR:O	5:R:81:THR:HG23	2.21	0.40
5:R:289:ASN:N	5:R:289:ASN:ND2	2.68	0.40
2:B:239:ASN:ND2	2:B:256:ARG:HH21	2.20	0.40
5:R:62:ARG:NH1	5:R:313:ASP:OD2	2.54	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	211/354 (60%)	202 (96%)	9 (4%)	0	100	100
2	B	327/339 (96%)	304 (93%)	23 (7%)	0	100	100
3	G	56/71 (79%)	55 (98%)	1 (2%)	0	100	100
4	L	11/13 (85%)	10 (91%)	1 (9%)	0	100	100
5	R	296/380 (78%)	274 (93%)	21 (7%)	1 (0%)	37	69
All	All	901/1157 (78%)	845 (94%)	55 (6%)	1 (0%)	50	80

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
5	R	280	PRO

### 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 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	190/305 (62%)	189 (100%)	1 (0%)	86	93
2	B	268/282 (95%)	265 (99%)	3 (1%)	70	86
3	G	47/58 (81%)	47 (100%)	0	100	100
4	L	11/11 (100%)	11 (100%)	0	100	100
5	R	255/327 (78%)	249 (98%)	6 (2%)	44	71
All	All	771/983 (78%)	761 (99%)	10 (1%)	64	83

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	260	THR
2	B	76	ASP
2	B	151	PHE
2	B	234	PHE
5	R	31	ILE
5	R	92	ASP
5	R	119	CYS
5	R	183	MET
5	R	253	LEU
5	R	301	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	244	HIS
2	B	91	HIS
2	B	155	ASN
2	B	176	GLN
2	B	239	ASN
3	G	24	ASN
4	L	7	HIS
5	R	289	ASN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

1 non-standard protein/DNA/RNA residue is modelled in this entry.

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
4	PCA	L	1	4	7,8,9	1.79	1 (14%)	9,10,12	2.11	5 (55%)

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
4	PCA	L	1	4	-	0/0/11/13	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	L	1	PCA	CD-N	4.61	1.46	1.34

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	L	1	PCA	OE-CD-CG	-3.05	121.45	126.76
4	L	1	PCA	CA-N-CD	-2.78	104.06	113.58
4	L	1	PCA	CB-CA-N	2.61	110.78	103.30
4	L	1	PCA	CB-CA-C	-2.54	109.20	112.70
4	L	1	PCA	CG-CD-N	2.43	114.69	108.39

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no oligosaccharides 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.