



## Full wwPDB EM Validation Report ⓘ

Jul 9, 2025 – 02:11 PM JST

PDB ID : 8ZPL / pdb\_00008zpl  
EMDB ID : EMD-60348  
Title : Cryo-EM strucutre of CXCR4 complexed with antagonist HF51116  
Authors : Jiao, H.Z.; Hu, H.L.  
Deposited on : 2024-05-30  
Resolution : 3.01 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 : 4-5-2 with Phenix2.0rc1  
buster-report : 1.1.7 (2018)  
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) : 2.44

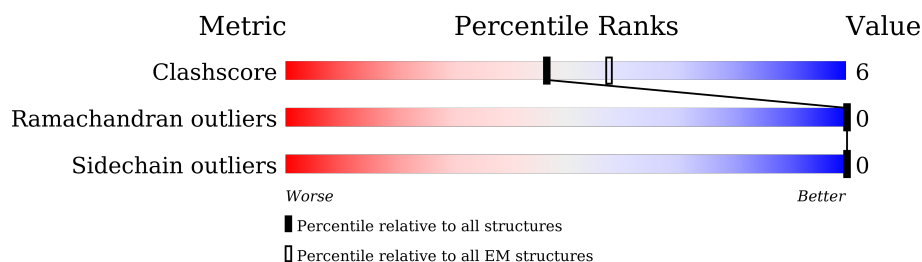
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*

The reported resolution of this entry is 3.01 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	N	169	
2	R	486	

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 3234 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 Nb6 nanobody.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	N	116	Total	C	N	O	S	0	0
			848	527	148	169	4		

- Molecule 2 is a protein called Soluble cytochrome b562,C-X-C chemokine receptor type 4.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	R	282	Total	C	N	O	S	0	0
			2292	1534	371	376	11		

There are 81 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
R	-137	MET	-	initiating methionine	UNP P0ABE7
R	-136	LYS	-	expression tag	UNP P0ABE7
R	-135	THR	-	expression tag	UNP P0ABE7
R	-134	ILE	-	expression tag	UNP P0ABE7
R	-133	ILE	-	expression tag	UNP P0ABE7
R	-132	ALA	-	expression tag	UNP P0ABE7
R	-131	LEU	-	expression tag	UNP P0ABE7
R	-130	SER	-	expression tag	UNP P0ABE7
R	-129	TYR	-	expression tag	UNP P0ABE7
R	-128	ILE	-	expression tag	UNP P0ABE7
R	-127	PHE	-	expression tag	UNP P0ABE7
R	-126	CYS	-	expression tag	UNP P0ABE7
R	-125	LEU	-	expression tag	UNP P0ABE7
R	-124	VAL	-	expression tag	UNP P0ABE7
R	-123	PHE	-	expression tag	UNP P0ABE7
R	-122	ALA	-	expression tag	UNP P0ABE7
R	-121	ASP	-	expression tag	UNP P0ABE7
R	-120	TYR	-	expression tag	UNP P0ABE7
R	-119	LYS	-	expression tag	UNP P0ABE7
R	-118	ASP	-	expression tag	UNP P0ABE7
R	-117	ASP	-	expression tag	UNP P0ABE7

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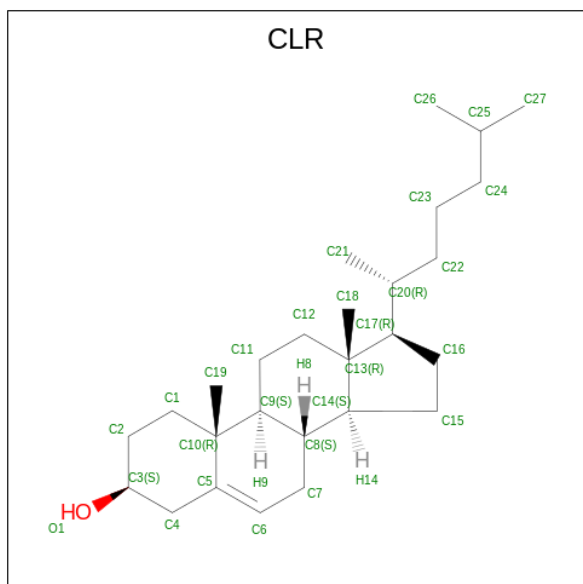
Chain	Residue	Modelled	Actual	Comment	Reference
R	-116	ASP	-	expression tag	UNP P0ABE7
R	-115	ASP	-	expression tag	UNP P0ABE7
R	-114	LYS	-	expression tag	UNP P0ABE7
R	-113	GLY	-	expression tag	UNP P0ABE7
R	-112	SER	-	expression tag	UNP P0ABE7
R	-105	TRP	MET	conflict	UNP P0ABE7
R	-10	ILE	HIS	conflict	UNP P0ABE7
R	-6	LEU	-	linker	UNP P0ABE7
R	-5	LEU	-	linker	UNP P0ABE7
R	-4	VAL	-	linker	UNP P0ABE7
R	-3	PRO	-	linker	UNP P0ABE7
R	-2	ARG	-	linker	UNP P0ABE7
R	-1	GLY	-	linker	UNP P0ABE7
R	0	SER	-	linker	UNP P0ABE7
R	125	TRP	LEU	conflict	UNP P61073
R	225	ARG	-	linker	UNP P61073
R	226	LEU	-	linker	UNP P61073
R	227	LYS	-	linker	UNP P61073
R	228	SER	-	linker	UNP P61073
R	229	VAL	-	linker	UNP P61073
R	230	ARG	-	linker	UNP P61073
R	231	LEU	-	linker	UNP P61073
R	232	LEU	-	linker	UNP P61073
R	233	SER	-	linker	UNP P61073
R	234	GLY	-	linker	UNP P61073
R	235	SER	-	linker	UNP P61073
R	236	ARG	-	linker	UNP P61073
R	237	GLU	-	linker	UNP P61073
R	238	LYS	-	linker	UNP P61073
R	239	ASP	-	linker	UNP P61073
R	240	ARG	-	linker	UNP P61073
R	241	ASN	-	linker	UNP P61073
R	242	LEU	-	linker	UNP P61073
R	243	ARG	-	linker	UNP P61073
R	244	ARG	-	linker	UNP P61073
R	245	ILE	-	linker	UNP P61073
R	246	THR	-	linker	UNP P61073
R	247	ARG	-	linker	UNP P61073
R	248	PRO	-	linker	UNP P61073
R	328	GLY	-	expression tag	UNP P61073
R	329	ARG	-	expression tag	UNP P61073
R	330	PRO	-	expression tag	UNP P61073

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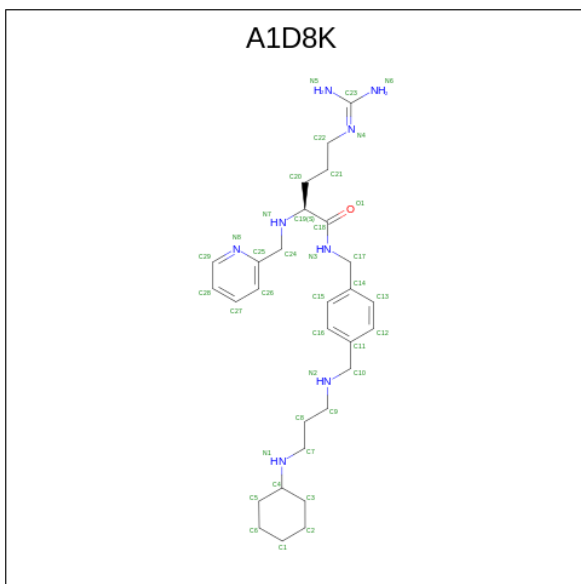
Chain	Residue	Modelled	Actual	Comment	Reference
R	331	LEU	-	expression tag	UNP P61073
R	332	GLU	-	expression tag	UNP P61073
R	333	VAL	-	expression tag	UNP P61073
R	334	LEU	-	expression tag	UNP P61073
R	335	PHE	-	expression tag	UNP P61073
R	336	GLN	-	expression tag	UNP P61073
R	337	GLY	-	expression tag	UNP P61073
R	338	PRO	-	expression tag	UNP P61073
R	339	HIS	-	expression tag	UNP P61073
R	340	HIS	-	expression tag	UNP P61073
R	341	HIS	-	expression tag	UNP P61073
R	342	HIS	-	expression tag	UNP P61073
R	343	HIS	-	expression tag	UNP P61073
R	344	HIS	-	expression tag	UNP P61073
R	345	HIS	-	expression tag	UNP P61073
R	346	HIS	-	expression tag	UNP P61073
R	347	HIS	-	expression tag	UNP P61073
R	348	HIS	-	expression tag	UNP P61073

- Molecule 3 is CHOLESTEROL (CCD ID: CLR) (formula:  $C_{27}H_{46}O$ ).



Mol	Chain	Residues	Atoms			AltConf
3	R	1	Total	C	O	0
			28	27	1	
3	R	1	Total	C	O	0
			28	27	1	

- Molecule 4 is (2S)-N-[[4-[[3-(cyclohexylamino)propylamino]methyl]phenyl]methyl]-5-(diaminomethylideneamino)-2-(pyridin-2-ylmethylamino)pentanamide (CCD ID: A1D8K) (formula:  $C_{29}H_{46}N_8O$ ) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				AltConf
			Total	C	N	O	
4	R	1	38	29	8	1	0



## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	142111	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 ( $e^-/\text{\AA}^2$ )	51.6	Depositor
Minimum defocus (nm)	1500	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor



## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CLR, A1D8K

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	N	0.08	0/862	0.20	0/1171
2	R	0.15	0/2355	0.31	0/3210
All	All	0.13	0/3217	0.29	0/4381

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	N	848	0	746	11	0
2	R	2292	0	2369	27	0
3	R	56	0	92	2	0
4	R	38	0	0	0	0
All	All	3234	0	3207	38	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 6.

All (38) 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:R:171:ASP:OD1	2:R:188:ARG:NH1	2.34	0.61
1:N:64:SER:O	1:N:68:ARG:NH2	2.37	0.57
2:R:144:SER:O	2:R:148:ARG:HB2	2.05	0.56
1:N:92:THR:HG23	1:N:120:THR:HA	1.89	0.54
2:R:101:ASN:OD1	2:R:184:TYR:N	2.42	0.53
2:R:49:PHE:HD2	2:R:50:LEU:HD12	1.74	0.52
2:R:77:ARG:HD2	2:R:310:TYR:OH	2.10	0.51
2:R:188:ARG:HH21	2:R:190:TYR:HE1	1.57	0.51
1:N:68:ARG:O	1:N:85:SER:OG	2.27	0.51
2:R:77:ARG:HD2	2:R:310:TYR:CZ	2.46	0.50
2:R:146:ARG:HB3	2:R:147:PRO:HD3	1.93	0.49
2:R:101:ASN:HD21	2:R:183:ARG:HA	1.76	0.49
1:N:8:GLU:OE1	1:N:116:GLY:N	2.29	0.49
2:R:62:VAL:HG13	2:R:68:LYS:HD3	1.95	0.49
2:R:144:SER:O	2:R:148:ARG:CB	2.61	0.48
2:R:60:ILE:HD11	2:R:82:VAL:HA	1.95	0.48
1:N:73:ARG:NE	1:N:75:ASN:OD1	2.46	0.47
1:N:98:ASN:OD1	1:N:99:ALA:N	2.48	0.46
2:R:264:TYR:HA	2:R:267:ILE:HG12	1.97	0.46
2:R:241:ASN:OD1	2:R:244:ARG:NH1	2.41	0.46
1:N:68:ARG:HG2	1:N:86:SER:HB3	1.98	0.46
2:R:262:PRO:HB2	2:R:295:THR:HG21	1.98	0.45
1:N:40:ARG:O	1:N:40:ARG:NE	2.48	0.45
2:R:255:ALA:HA	3:R:402:CLR:H183	1.99	0.45
2:R:239:ASP:O	2:R:243:ARG:HG2	2.17	0.44
1:N:20:LEU:HB2	1:N:84:MET:HB2	1.99	0.44
2:R:118:VAL:HG23	2:R:168:THR:HG21	1.98	0.44
2:R:131:SER:OG	2:R:215:ILE:HG12	2.19	0.43
2:R:210:LEU:HB2	2:R:211:PRO:HD3	2.00	0.43
2:R:237:GLU:HG2	2:R:238:LYS:N	2.33	0.42
2:R:306:ASN:HB2	2:R:307:PRO:HD3	2.01	0.42
2:R:134:ARG:NH2	2:R:148:ARG:HH21	2.17	0.42
2:R:262:PRO:HB2	2:R:295:THR:CG2	2.49	0.42
2:R:264:TYR:HD1	2:R:267:ILE:HD11	1.84	0.42
2:R:270:ASP:HB2	2:R:292:ILE:HD11	2.01	0.42
1:N:36:MET:HE2	1:N:36:MET:HB3	1.99	0.41
2:R:223:ILE:HD11	3:R:401:CLR:H11	2.01	0.41
1:N:25:ALA:HA	1:N:79:THR:HG22	2.02	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles

### 5.3.1 Protein backbone

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	N	112/169 (66%)	111 (99%)	1 (1%)	0	100	100
2	R	280/486 (58%)	265 (95%)	15 (5%)	0	100	100
All	All	392/655 (60%)	376 (96%)	16 (4%)	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 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	N	77/138 (56%)	77 (100%)	0	100	100
2	R	251/424 (59%)	251 (100%)	0	100	100
All	All	328/562 (58%)	328 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
2	R	202	GLN

### 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 oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

3 ligands are 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	$\# Z  > 2$
3	CLR	R	402	-	31,31,31	0.37	0	48,48,48	0.45	0
3	CLR	R	401	-	31,31,31	0.40	0	48,48,48	0.66	0
4	A1D8K	R	403	-	40,40,40	0.39	0	46,49,49	0.68	1 (2%)

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	CLR	R	402	-	-	5/10/68/68	0/4/4/4
3	CLR	R	401	-	-	5/10/68/68	0/4/4/4
4	A1D8K	R	403	-	-	13/28/38/38	0/3/3/3

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	R	403	A1D8K	C22-N4-C23	-3.50	114.15	122.00

There are no chirality outliers.

All (23) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	R	403	A1D8K	N7-C19-C20-C21
4	R	403	A1D8K	C3-C4-N1-C7
3	R	401	CLR	C17-C20-C22-C23
4	R	403	A1D8K	C19-C18-N3-C17
3	R	401	CLR	C21-C20-C22-C23
4	R	403	A1D8K	O1-C18-N3-C17
4	R	403	A1D8K	C20-C21-C22-N4
3	R	402	CLR	C21-C20-C22-C23
4	R	403	A1D8K	C11-C10-N2-C9
4	R	403	A1D8K	N1-C7-C8-C9
4	R	403	A1D8K	C18-C19-C20-C21
4	R	403	A1D8K	C7-C8-C9-N2
3	R	402	CLR	C13-C17-C20-C22
4	R	403	A1D8K	C8-C7-N1-C4
3	R	402	CLR	C16-C17-C20-C21
3	R	402	CLR	C13-C17-C20-C21
3	R	402	CLR	C16-C17-C20-C22
3	R	401	CLR	C13-C17-C20-C21
4	R	403	A1D8K	C5-C4-N1-C7
3	R	401	CLR	C16-C17-C20-C22
3	R	401	CLR	C20-C22-C23-C24
4	R	403	A1D8K	N7-C24-C25-N8
4	R	403	A1D8K	C20-C19-N7-C24

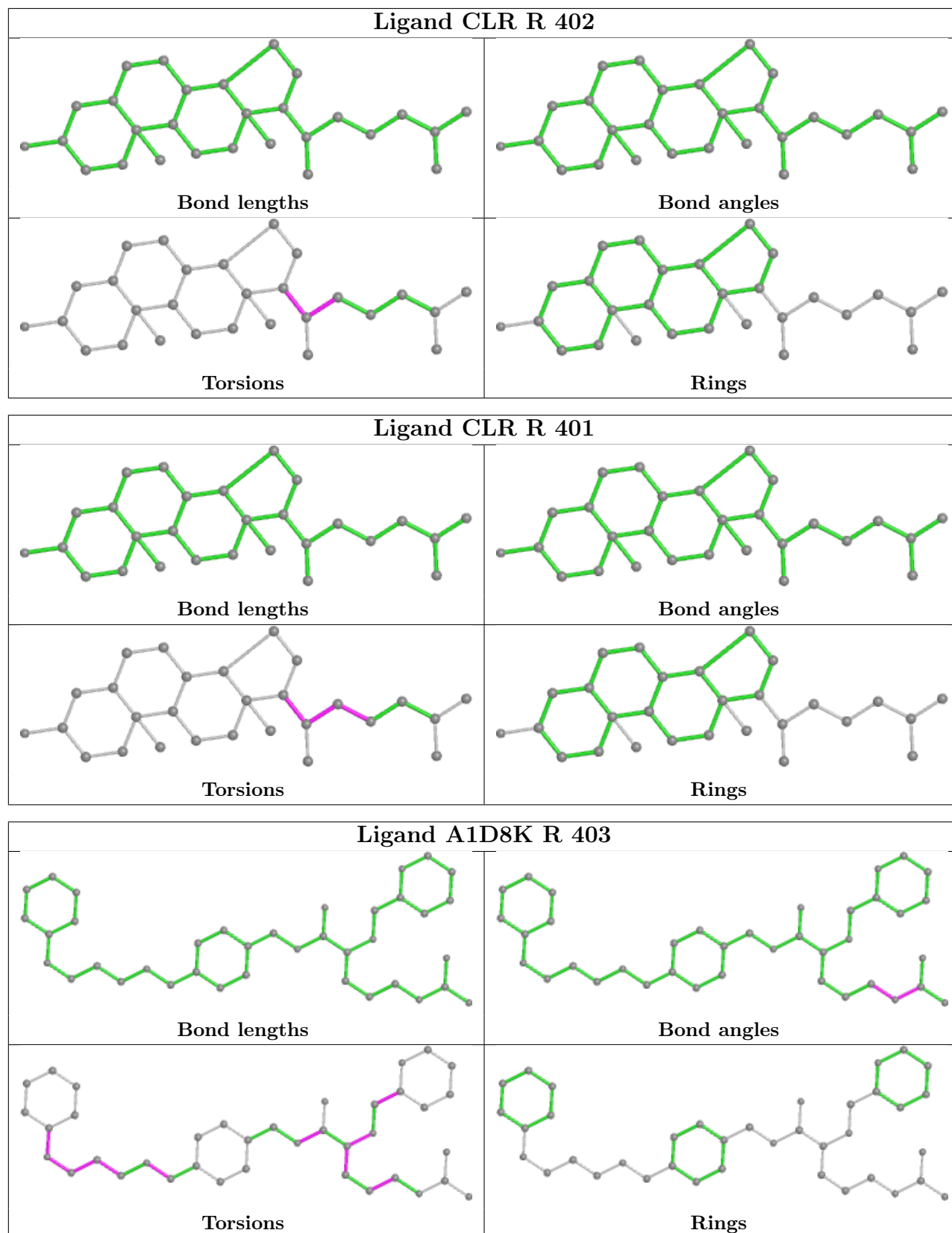
There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	R	402	CLR	1	0
3	R	401	CLR	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and

any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



## 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.