WORLDWIDE wwPDB PROTEIN DATA BANK

wwPDB EM Validation Summary Report (i)

Jun 27, 2024 – 10:07 PM JST

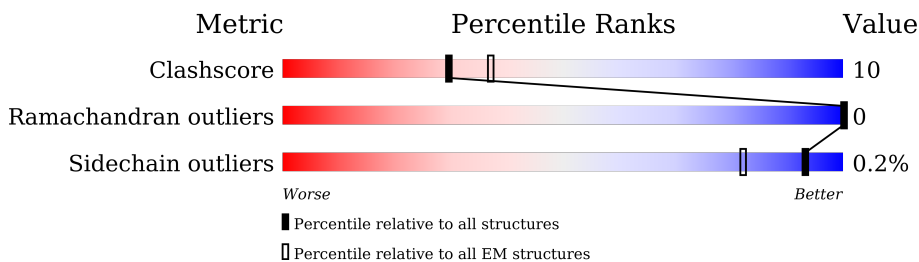|		
PDB ID	:	8YUU
EMDB ID	:	EMD-39583
Title	:	Cryo-EM structure of the histamine-bound H3R-Gi complex
Authors	:	Shen, Q.; Tang, X.; Wen, X.; Cheng, S.; Xiao, P.; Zang, S.; Shen, D.; Jiang, L.; Zheng, Y.; Zhang, H.; Xu, H.; Mao, C.; Zhang, M.; Hu, W.; Sun, J.; Chen, Z.; Zhang, Y.
Deposited on	:	2024-03-27
Resolution	:	2.70 Å(reported)

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 2.70 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	Percentile Ranks	Value
Clashscore		10
Ramachandran outliers		0
Sidechain outliers		0.2%

Worse   *Better*

▮ Percentile relative to all structures
▯ Percentile relative to all EM structures

Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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 >=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 <=5%

Mol	Chain	Length	Quality of chain
1	R	461	41% 22% 37%
2	A	354	54% 10% 36%
3	B	358	77% 18% 5%
4	G	71	69% 13% 18%
5	S	269	72% 15% 13%

2 Entry composition ⓘ

There are 7 unique types of molecules in this entry. The entry contains 9037 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 Histamine H3 receptor.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	R	289	Total 2344	C 1559	N 389	O 384	S 12	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
R	-15	ASP	-	expression tag	UNP Q9Y5N1
R	-14	TYR	-	expression tag	UNP Q9Y5N1
R	-13	LYS	-	expression tag	UNP Q9Y5N1
R	-12	ASP	-	expression tag	UNP Q9Y5N1
R	-11	ASP	-	expression tag	UNP Q9Y5N1
R	-10	ASP	-	expression tag	UNP Q9Y5N1
R	-9	ASP	-	expression tag	UNP Q9Y5N1
R	-8	LYS	-	expression tag	UNP Q9Y5N1
R	-7	LEU	-	expression tag	UNP Q9Y5N1
R	-6	GLU	-	expression tag	UNP Q9Y5N1
R	-5	VAL	-	expression tag	UNP Q9Y5N1
R	-4	LEU	-	expression tag	UNP Q9Y5N1
R	-3	PHE	-	expression tag	UNP Q9Y5N1
R	-2	GLN	-	expression tag	UNP Q9Y5N1
R	-1	GLY	-	expression tag	UNP Q9Y5N1
R	0	PRO	-	expression tag	UNP Q9Y5N1

- Molecule 2 is a protein called Guanine nucleotide-binding protein G(i) subunit alpha-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	A	225	Total 1811	C 1150	N 301	O 346	S 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

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

- Molecule 3 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		
3	B	339	2607	1607	468	511	21	0	0

There are 19 discrepancies between the modelled and reference sequences:

| Chain	Residue	Modelled	Actual	Comment	Reference
B	-17	MET	-	initiating methionine	UNP P62873
B	-16	HIS	-	expression tag	UNP P62873
B	-15	HIS	-	expression tag	UNP P62873
B	-14	HIS	-	expression tag	UNP P62873
B	-13	HIS	-	expression tag	UNP P62873
B	-12	HIS	-	expression tag	UNP P62873
B	-11	HIS	-	expression tag	UNP P62873
B	-10	LEU	-	expression tag	UNP P62873
B	-9	GLU	-	expression tag	UNP P62873
B	-8	VAL	-	expression tag	UNP P62873
B	-7	LEU	-	expression tag	UNP P62873
B	-6	PHE	-	expression tag	UNP P62873
B	-5	GLN	-	expression tag	UNP P62873
B	-4	GLY	-	expression tag	UNP P62873
B	-3	PRO	-	expression tag	UNP P62873
B	-2	GLY	-	expression tag	UNP P62873
B	-1	SER	-	expression tag	UNP P62873
B	0	SER	-	expression tag	UNP P62873
B	1	GLY	-	expression tag	UNP P62873

- Molecule 4 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		
4	G	58	444	277	79	85	3	0	0

- Molecule 5 is a protein called scFv16.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	S	234	1795	1137	297	351	10	0	0

- Molecule 6 is HISTAMINE (three-letter code: HSM) (formula: $C_5H_9N_3$) (labeled as "Ligand of Interest" by depositor).

HSM
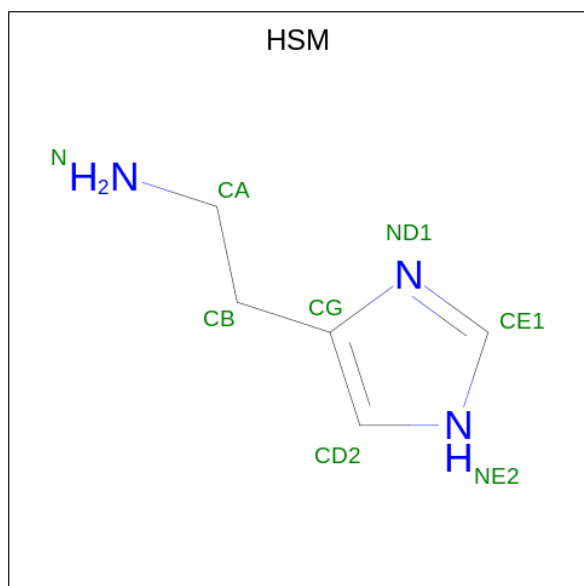
Mol	Chain	Residues	Atoms			AltConf
			Total	C	N	
6	R	1	8	5	3	0

- Molecule 7 is CHOLESTEROL (three-letter code: CLR) (formula: $C_{27}H_{46}O$).

CLR
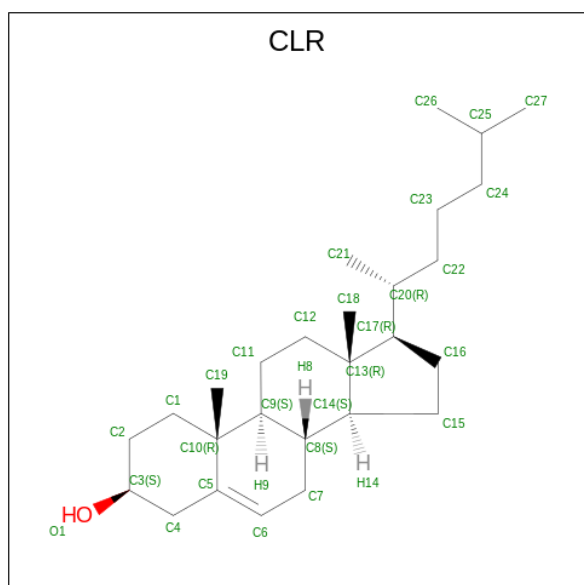
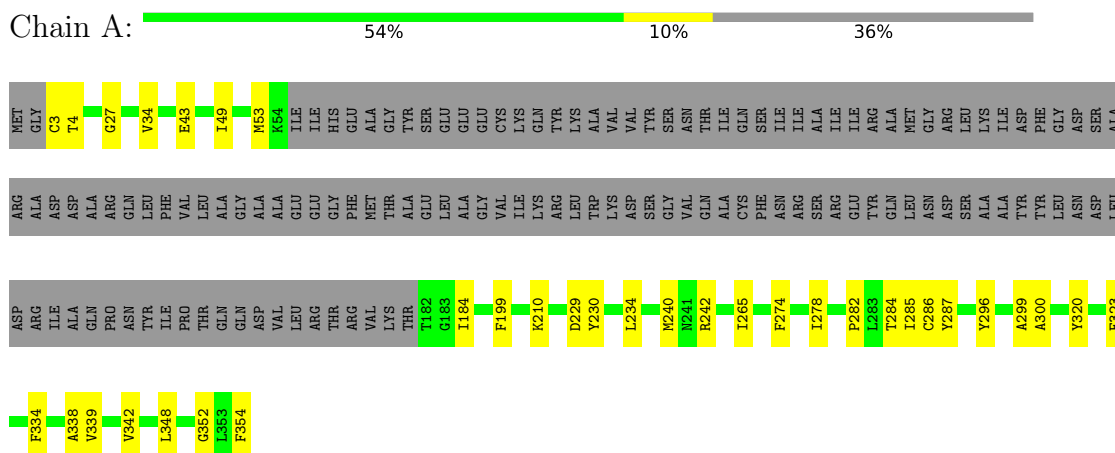| Mol	Chain	Residues	Atoms			AltConf
7	R	1	Total 28	C 27	O 1	0

3 Residue-property plots ⓘ

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.

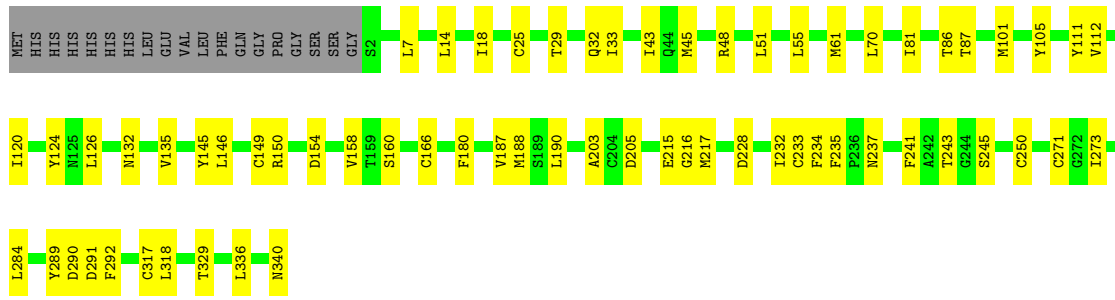• Molecule 1: Histamine H3 receptor
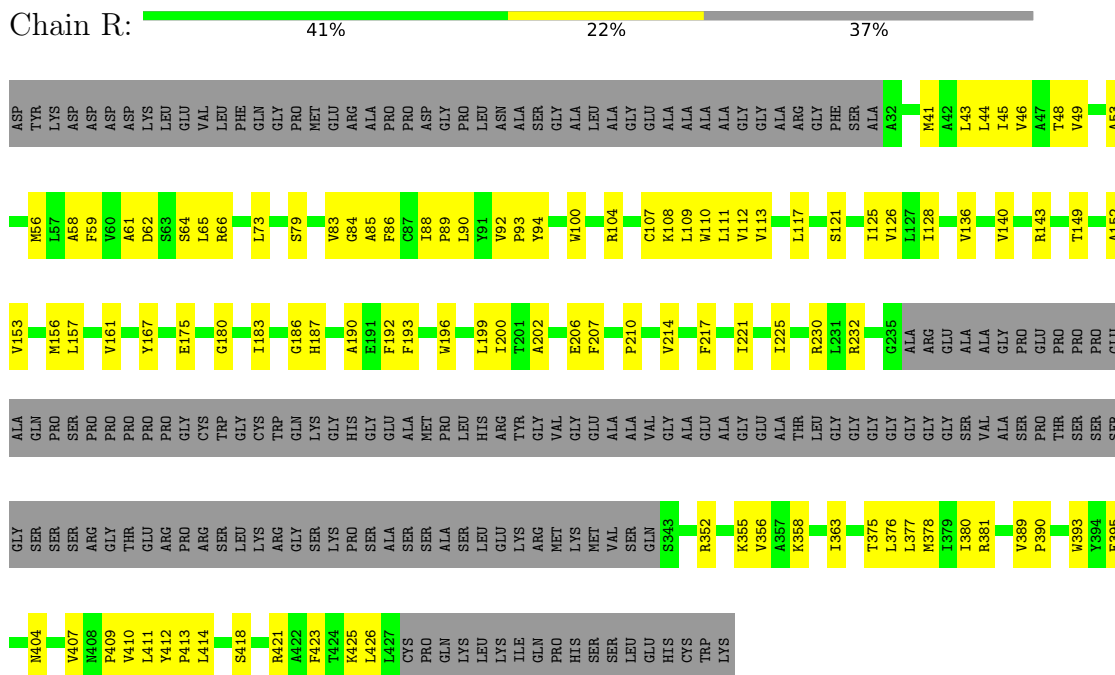
• Molecule 2: Guanine nucleotide-binding protein G(i) subunit alpha-1

• Molecule 3: Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1

Chain B:

77%   18%   5%

MET HIS HIS HIS HIS HIS LEU GLU VAL LEU PHE GLN GLY PRO GLY SER SER GLY S2 L7 L14 I18 C25 T29 Q32 I33 I43 Q44 M45 R48 L51 L55 M61 L70 I81 T86 T87 M101 Y105 Y111 V112

I120 Y124 N125 L126 N132 V135 Y145 L146 C149 R150 D154 V158 T159 S160 C166 F180 V187 M188 S189 L190 A203 C204 D205 E215 G216 M217 D228 I232 C233 F234 F235 P236 N237 F241 A242 T243 G244 S245 C250 C271 G272 I273

L284 Y289 D290 D291 F292 C317 L318 T329 L336 N340

● Molecule 4: Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2

Chain G:

69%   13%   18%

MET ALA SER ASN N5 A12 V16 K20 V30 A34 L50 A56 N59 R62 GLU LYS LYS PHE PHE CYS ALA ILE LEU

● Molecule 5: scFv16

Chain S:

72%   15%   13%

D1 L4 V5 E6 V12 S17 R18 C22 A28 M34 Y50 I51 Y59 R67 F68 R72 D73 D74 P75 T78 L79 F80 M83 T84 Y94 S99 P107 G114 T115 S121 GLY GLY GLY SER GLY GLY GLY GLY SER GLY GLY

G135 T144 V147 S154 S164 L174 L187 Y190 R191 M192 R202 S208 G209 T210 I216 S217 C229 L247 LYS GLY SER LEU GLU VAL LEU PHE GLN GLY PRO ALA ALA ALA HIS HIS HIS HIS HIS HIS HIS HIS HIS
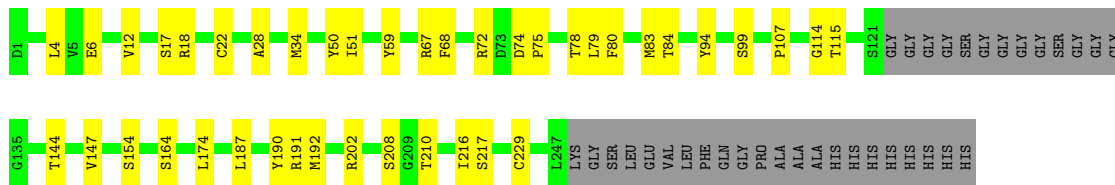
4   Experimental information ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	234203	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 $(e^-/\text{Å}^2)$	62	Depositor
Minimum defocus (nm)	500	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (4k 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, HSM

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	R	0.29	0/2414	0.46	0/3292
2	A	0.29	0/1841	0.45	0/2471
3	B	0.32	0/2654	0.59	0/3597
4	G	0.27	0/450	0.45	0/608
5	S	0.34	0/1839	0.55	0/2493
All	All	0.31	0/9198	0.52	0/12461

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	R	2344	0	2367	89	0
2	A	1811	0	1799	29	0
3	B	2607	0	2510	50	0
4	G	444	0	454	10	0
5	S	1795	0	1727	24	0
6	R	8	0	9	0	0
7	R	28	0	46	5	0
All	All	9037	0	8912	182	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 10.

The worst 5 of 182 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:R:232:ARG:HH22	2:A:320:TYR:HA	1.29	0.96
1:R:412:TYR:HB2	1:R:413:PRO:HD3	1.54	0.88
1:R:410:VAL:HA	1:R:414:LEU:HD12	1.57	0.86
1:R:377:LEU:HD11	1:R:389:VAL:CG1	2.07	0.84
1:R:381:ARG:HG3	1:R:389:VAL:HG21	1.64	0.78

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	R	285/461 (62%)	268 (94%)	17 (6%)	0	100	100
2	A	221/354 (62%)	218 (99%)	3 (1%)	0	100	100
3	B	337/358 (94%)	325 (96%)	12 (4%)	0	100	100
4	G	56/71 (79%)	56 (100%)	0	0	100	100
5	S	230/269 (86%)	223 (97%)	7 (3%)	0	100	100
All	All	1129/1513 (75%)	1090 (96%)	39 (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	R	249/372 (67%)	249 (100%)	0	100	100
2	A	200/305 (66%)	200 (100%)	0	100	100
3	B	282/298 (95%)	280 (99%)	2 (1%)	84	94
4	G	47/58 (81%)	47 (100%)	0	100	100
5	S	198/217 (91%)	198 (100%)	0	100	100
All	All	976/1250 (78%)	974 (100%)	2 (0%)	93	98

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	B	105	TYR
3	B	234	PHE

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

Mol	Chain	Res	Type
3	B	176	GLN
3	B	340	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 monosaccharides in this entry.

5.6   Ligand geometry ⓘ

2 ligands are modelled in this entry.

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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	$\#|Z| > 2$
6	HSM	R	501	-	3,8,8	0.34	0	3,9,9	0.67	0
7	CLR	R	502	-	31,31,31	1.24	1 (3%)	48,48,48	1.44	10 (20%)

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
6	HSM	R	501	-	-	1/2/3/3	0/1/1/1
7	CLR	R	502	-	-	2/10/68/68	0/4/4/4

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	R	502	CLR	C16-C17	3.24	1.61	1.54

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
7	R	502	CLR	C11-C9-C8	2.63	115.54	111.75
7	R	502	CLR	C11-C9-C10	2.61	116.51	113.08
7	R	502	CLR	C3-C4-C5	2.60	116.43	112.03
7	R	502	CLR	C15-C14-C13	2.43	106.78	103.84
7	R	502	CLR	C10-C9-C8	-2.30	109.28	112.73

There are no chirality outliers.

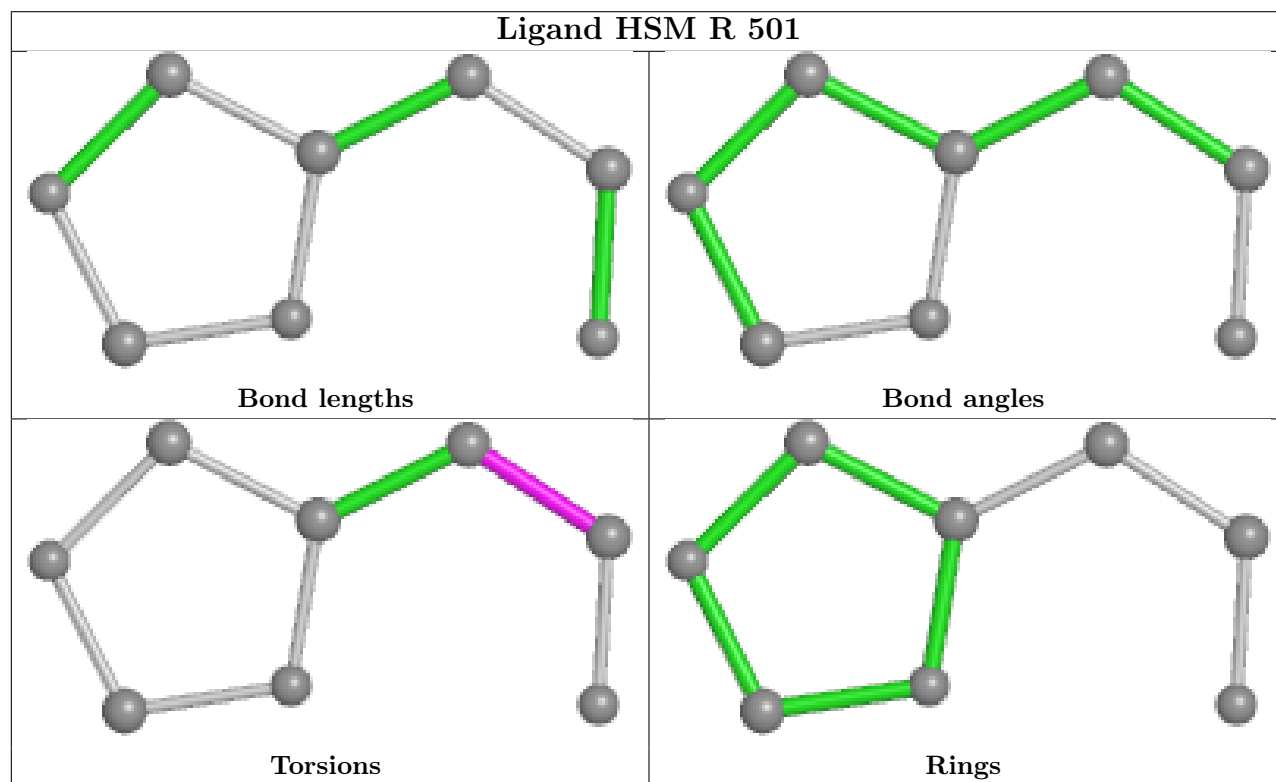All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	R	501	HSM	N-CA-CB-CG
7	R	502	CLR	C21-C20-C22-C23
7	R	502	CLR	C17-C20-C22-C23

There are no ring outliers.

1 monomer is involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	R	502	CLR	5	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 then 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.

Ligand HSM R 501

Bond lengths

Bond angles

Torsions

Rings

Ligand CLR R 502	
Bond lengths	Bond angles
Torsions	Rings
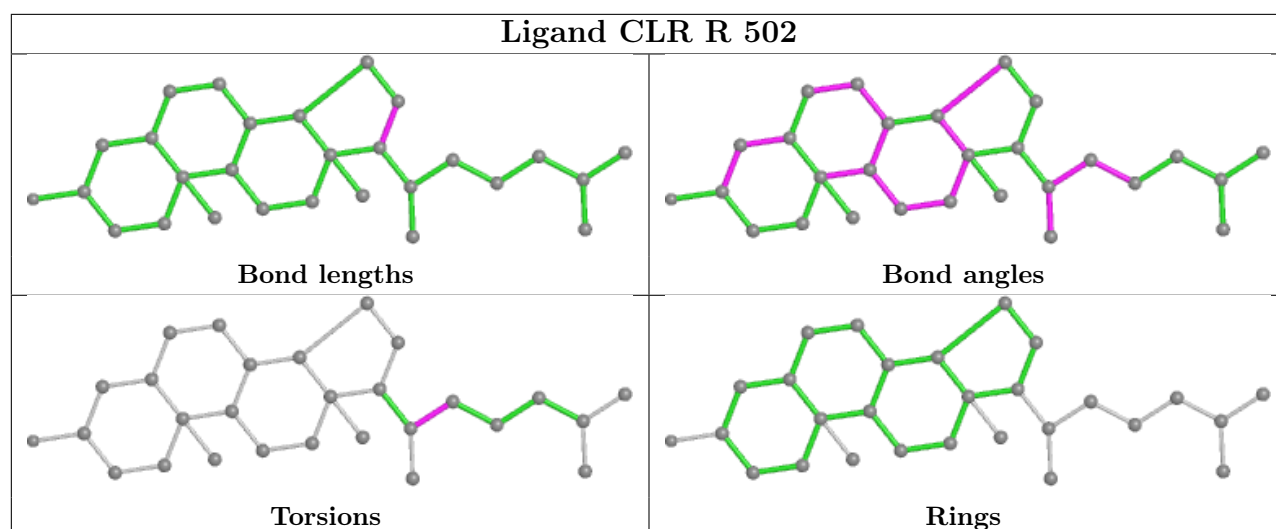
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.