



# wwPDB X-ray Structure Validation Summary Report

May 29, 2024 – 12:15 PM EDT

PDB ID : 1RLB  
Title : RETINOL BINDING PROTEIN COMPLEXED WITH TRANSTHYRETIN  
Authors : Monaco, H.L.; Rizzi, M.; Coda, A.  
Deposited on : 1995-02-20  
Resolution : 3.10 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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/XrayValidationReportHelp>

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:

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36.2

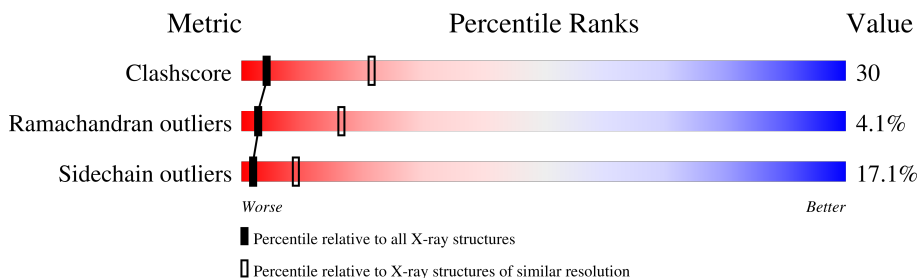
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.10 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)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	1184 (3.10-3.10)
Ramachandran outliers	138981	1141 (3.10-3.10)
Sidechain outliers	138945	1141 (3.10-3.10)

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

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	127	52% 30% 13% . .
1	B	127	43% 41% 9% . 6%
1	C	127	45% 31% 19% . .
1	D	127	29% 50% 9% 6% 6%
2	E	174	44% 40% 11% 5%
2	F	174	46% 40% 11% .

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit crite-

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	REA	E	176	-	-	X	-
3	REA	F	177	-	X	-	-

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6624 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, 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 TRANSTHYRETIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	123	950	604	157	187	2	27	0	0
1	B	120	930	593	154	181	2	0	0	0
1	C	123	950	604	157	187	2	0	0	0
1	D	120	930	593	154	181	2	0	0	0

- Molecule 2 is a protein called RETINOL BINDING PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	E	174	1411	889	246	266	10	68	0	0
2	F	174	1411	889	246	266	10	116	0	0

There are 26 discrepancies between the modelled and reference sequences:

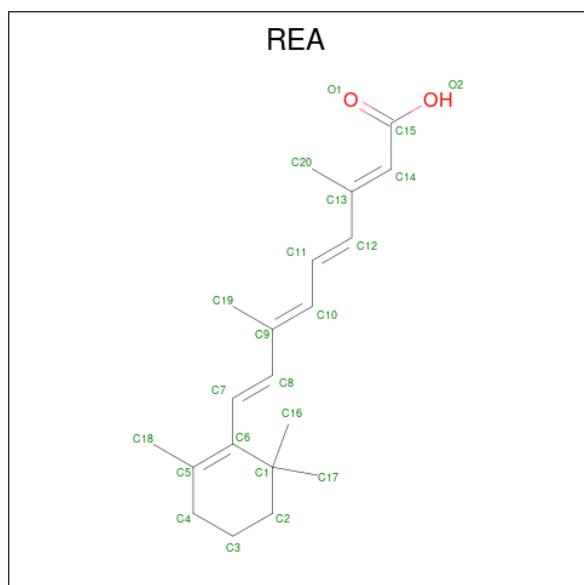
Chain	Residue	Modelled	Actual	Comment	Reference
E	21	ALA	SER	conflict	UNP P02753
E	50	ASN	THR	conflict	UNP P02753
E	52	HIS	GLN	conflict	UNP P02753
E	107	ILE	VAL	conflict	UNP P02753
E	112	GLU	ASP	conflict	UNP P02753
E	114	PHE	TYR	conflict	UNP P02753
E	138	ALA	SER	conflict	UNP P02753
E	142	SER	ASN	conflict	UNP P02753
E	144	PHE	LEU	conflict	UNP P02753
E	145	SER	PRO	conflict	UNP P02753
E	147	GLN	GLU	conflict	UNP P02753
E	148	VAL	ALA	conflict	UNP P02753

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Chain	Residue	Modelled	Actual	Comment	Reference
E	169	PRO	VAL	conflict	UNP P02753
F	21	ALA	SER	conflict	UNP P02753
F	50	ASN	THR	conflict	UNP P02753
F	52	HIS	GLN	conflict	UNP P02753
F	107	ILE	VAL	conflict	UNP P02753
F	112	GLU	ASP	conflict	UNP P02753
F	114	PHE	TYR	conflict	UNP P02753
F	138	ALA	SER	conflict	UNP P02753
F	142	SER	ASN	conflict	UNP P02753
F	144	PHE	LEU	conflict	UNP P02753
F	145	SER	PRO	conflict	UNP P02753
F	147	GLN	GLU	conflict	UNP P02753
F	148	VAL	ALA	conflict	UNP P02753
F	169	PRO	VAL	conflict	UNP P02753

- Molecule 3 is RETINOIC ACID (three-letter code: REA) (formula: C<sub>20</sub>H<sub>28</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	E	1	Total	C	O	0	0
			21	20	1		
3	F	1	Total	C	O	0	0
			21	20	1		

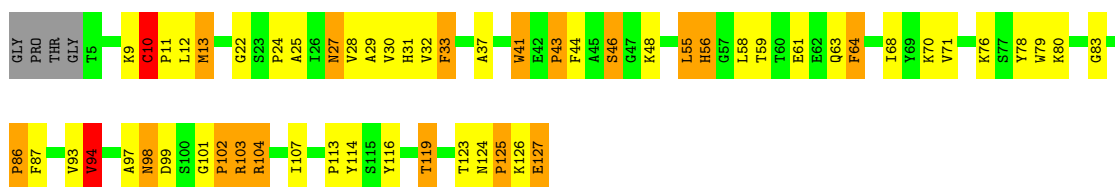
### 3 Residue-property plots [i](#)

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.

Note EDS was not executed.

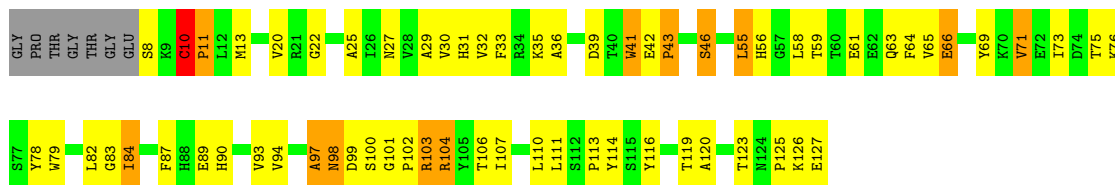
- Molecule 1: TRANSTHYRETIN

Chain A: 



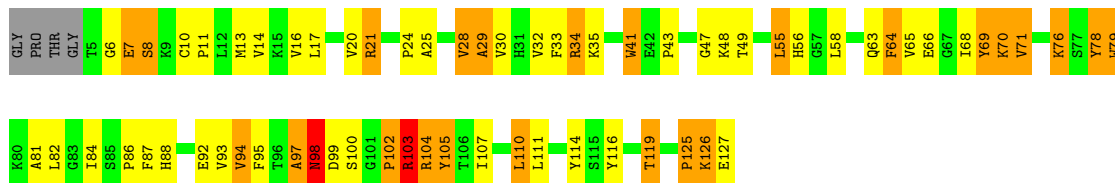
- Molecule 1: TRANSTHYRETIN

Chain B: 



- Molecule 1: TRANSTHYRETIN

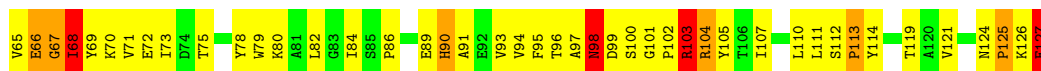
Chain C: 



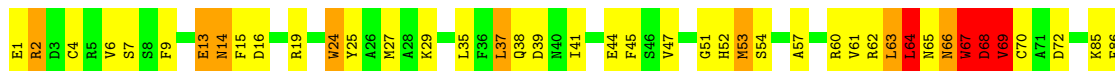
- Molecule 1: TRANSTHYRETIN

Chain D: 

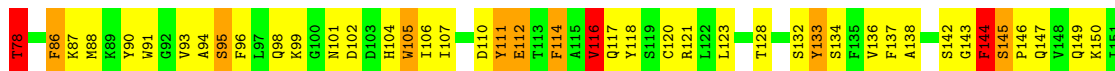




• Molecule 2: RETINOL BINDING PROTEIN



• Molecule 2: RETINOL BINDING PROTEIN



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	222.40Å 163.40Å 55.50Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	6.00 – 3.10	Depositor
% Data completeness (in resolution range)	93.5 (6.00-3.10)	Depositor
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, $R_{free}$	0.215 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	6624	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	29.0	wwPDB-VP



## 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: REA

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	1.11	2/974 (0.2%)	1.74	16/1325 (1.2%)
1	B	1.07	0/954	1.82	23/1298 (1.8%)
1	C	1.06	0/974	1.93	28/1325 (2.1%)
1	D	1.04	0/954	1.52	13/1298 (1.0%)
2	E	1.21	5/1445 (0.3%)	2.22	59/1950 (3.0%)
2	F	1.30	3/1445 (0.2%)	2.11	45/1950 (2.3%)
All	All	1.15	10/6746 (0.1%)	1.94	184/9146 (2.0%)

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	C	0	1
2	E	0	1
All	All	0	2

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	F	162	ALA	C-N	-26.18	0.73	1.34
2	F	163	ARG	N-CA	-13.27	1.19	1.46
1	A	98	ASN	C-O	12.00	1.46	1.23
2	E	69	VAL	N-CA	11.84	1.70	1.46
2	E	99	LYS	N-CA	7.11	1.60	1.46

The worst 5 of 184 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	F	162	ALA	O-C-N	25.37	163.29	122.70
2	F	162	ALA	C-N-CA	-21.22	68.66	121.70
2	E	68	ASP	C-N-CA	18.52	168.01	121.70
2	F	162	ALA	CA-C-N	-17.98	77.66	117.20
2	E	121	ARG	NE-CZ-NH1	17.79	129.19	120.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	69	TYR	Sidechain
2	E	68	ASP	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	950	0	924	47	0
1	B	930	0	908	47	0
1	C	950	0	924	53	0
1	D	930	0	908	103	5
2	E	1411	0	1334	69	0
2	F	1411	0	1334	58	0
3	E	21	0	27	16	0
3	F	21	0	27	7	0
All	All	6624	0	6386	372	5

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 30.

The worst 5 of 372 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:E:69:VAL:N	2:E:69:VAL:CA	1.70	1.51
1:B:66:GLU:HG2	1:B:98:ASN:O	1.14	1.27
1:B:100:SER:O	1:B:102:PRO:HD3	1.41	1.20

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:61:GLU:OE2	1:A:103:ARG:HD3	1.40	1.19
1:C:97:ALA:HB3	1:C:98:ASN:ND2	1.58	1.18

All (5) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:66:GLU:CD	1:D:66:GLU:OE1[3_655]	0.16	2.04
1:D:66:GLU:OE1	1:D:66:GLU:OE1[3_655]	1.18	1.02
1:D:66:GLU:CD	1:D:66:GLU:CD[3_655]	1.41	0.79
1:D:66:GLU:OE1	1:D:66:GLU:OE2[3_655]	1.43	0.77
1:D:66:GLU:CG	1:D:66:GLU:OE1[3_655]	1.51	0.69

## 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 X-ray entries followed by that with respect to entries of similar resolution.

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	121/127 (95%)	100 (83%)	17 (14%)	4 (3%)	4	21
1	B	118/127 (93%)	97 (82%)	16 (14%)	5 (4%)	3	16
1	C	121/127 (95%)	93 (77%)	23 (19%)	5 (4%)	3	16
1	D	118/127 (93%)	89 (75%)	21 (18%)	8 (7%)	1	7
2	E	172/174 (99%)	145 (84%)	20 (12%)	7 (4%)	3	16
2	F	172/174 (99%)	143 (83%)	24 (14%)	5 (3%)	4	24
All	All	822/856 (96%)	667 (81%)	121 (15%)	34 (4%)	3	16

5 of 34 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	37	ALA
1	A	125	PRO

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Mol	Chain	Res	Type
1	B	98	ASN
1	B	125	PRO
1	C	98	ASN

### 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 X-ray entries followed by that with respect to entries of similar resolution.

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	103/105 (98%)	87 (84%)	16 (16%)	2	11
1	B	101/105 (96%)	89 (88%)	12 (12%)	5	20
1	C	103/105 (98%)	83 (81%)	20 (19%)	1	6
1	D	101/105 (96%)	81 (80%)	20 (20%)	1	5
2	E	150/150 (100%)	123 (82%)	27 (18%)	1	7
2	F	150/150 (100%)	124 (83%)	26 (17%)	2	9
All	All	708/720 (98%)	587 (83%)	121 (17%)	2	9

5 of 121 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	55	LEU
2	F	114	PHE
2	E	14	ASN
2	F	112	GLU
2	F	158	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 20 such sidechains are listed below:

Mol	Chain	Res	Type
2	F	66	ASN
2	F	117	GLN
2	F	156	GLN
2	F	124	ASN
1	C	31	HIS

### 5.3.3 RNA [i](#)

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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

2 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	REA	E	176	-	21,21,22	1.57	3 (14%)	27,28,30	6.26	20 (74%)
3	REA	F	177	-	21,21,22	1.82	5 (23%)	27,28,30	8.58	20 (74%)

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	REA	E	176	-	-	6/14/31/32	0/1/1/1
3	REA	F	177	-	-	9/14/31/32	0/1/1/1

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	F	177	REA	O1-C15	5.24	1.38	1.22

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	E	176	REA	O1-C15	4.69	1.37	1.22
3	F	177	REA	C10-C9	3.66	1.40	1.35
3	F	177	REA	C11-C12	2.42	1.40	1.34
3	E	176	REA	C10-C9	2.42	1.39	1.35

The worst 5 of 40 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	F	177	REA	C18-C5-C6	-26.71	94.54	124.53
3	F	177	REA	C16-C1-C6	15.10	134.79	110.30
3	F	177	REA	O1-C15-C14	-13.54	107.18	123.66
3	E	176	REA	C7-C8-C9	-12.91	106.73	126.23
3	E	176	REA	C20-C13-C14	-11.79	106.41	122.92

There are no chirality outliers.

5 of 15 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	E	176	REA	C11-C10-C9-C19
3	E	176	REA	C20-C13-C14-C15
3	E	176	REA	C13-C14-C15-O1
3	F	177	REA	C11-C10-C9-C19
3	F	177	REA	C20-C13-C14-C15

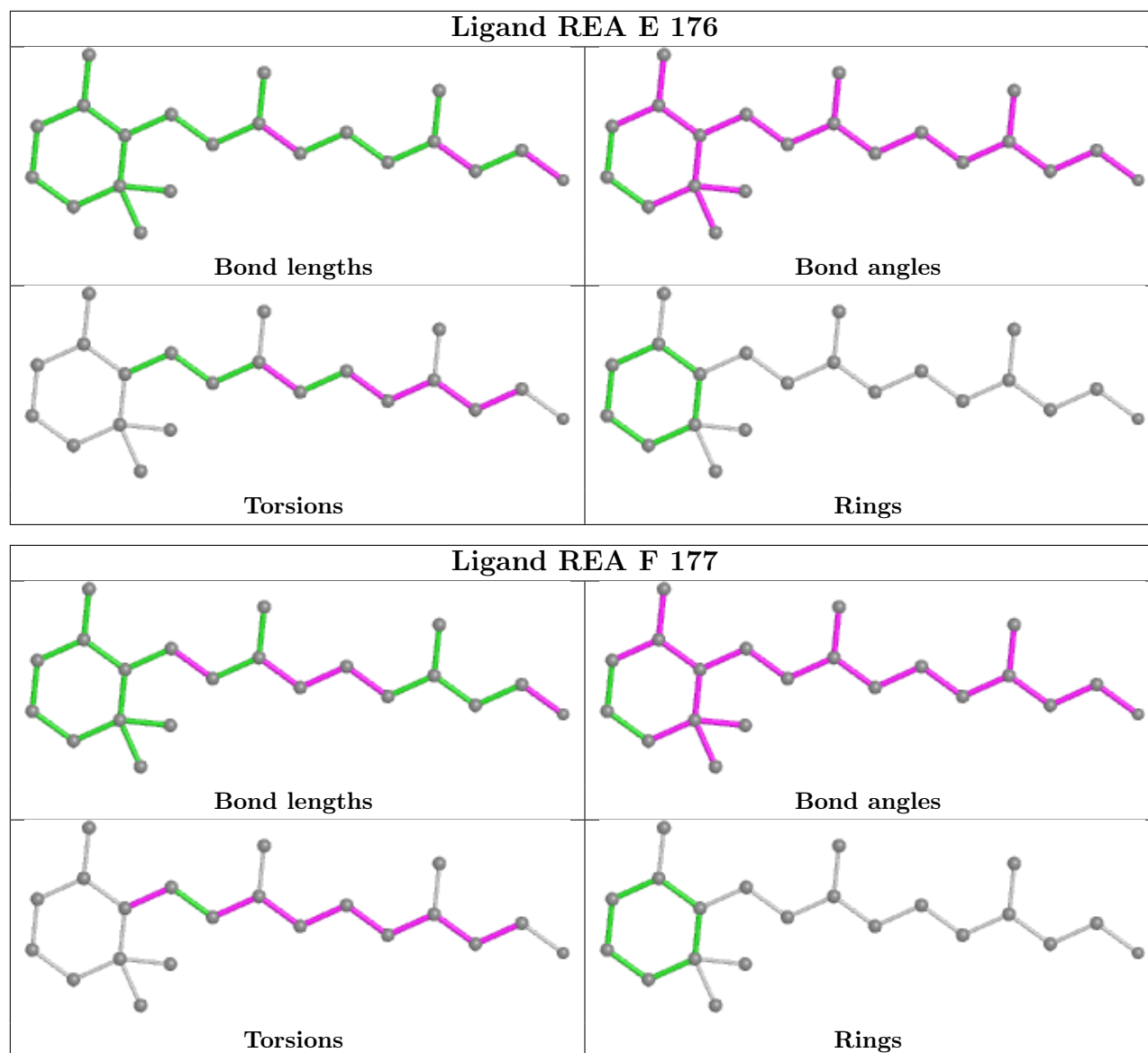
There are no ring outliers.

2 monomers are involved in 23 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	E	176	REA	16	0
3	F	177	REA	7	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 [\(i\)](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
2	F	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	F	162:ALA	C	163:ARG	N	0.73



## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

### 6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.