W O R L D W I D E

wwPDB

P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 12, 2021 – 12:59 PM EDT

PDB ID	:	2A5Y
Title	:	Structure of a CED-4/CED-9 complex
Authors	:	Yan, N.; Liu, Q.; Hao, Q.; Gu, L.; Shi, Y.
Deposited on	:	2005-07-01
Resolution	:	2.60 Å(reported)

The following versions of software and data (see references ⓘ) were used in the production of this report:

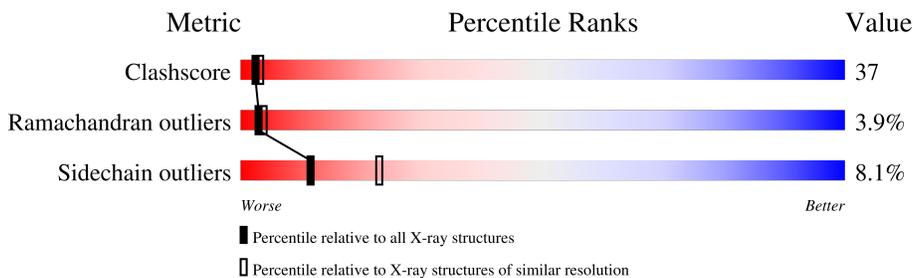|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

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 2.60 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		37
Ramachandran outliers		3.9%
Sidechain outliers		8.1%

Worse   *Better*

■ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)

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 >=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%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	204	45% 36% • 15%
2	B	549	39% 45% 7% 9%
2	C	549	31% 32% 5% 32%

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 8730 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 Apoptosis regulator ced-9.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	173	Total	C	N	O	S	0	0	0
			1417	900	246	262	9			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	107	SER	CYS	engineered mutation	UNP P41958
A	135	SER	CYS	engineered mutation	UNP P41958
A	164	SER	CYS	engineered mutation	UNP P41958

- Molecule 2 is a protein called ced-4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	501	Total	C	N	O	S	0	0	0
			4028	2568	674	757	29			
2	C	373	Total	C	N	O	S	0	0	0
			2961	1885	493	558	25			

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	Mg	0	0
			1	1		
3	C	1	Total	Mg	0	0
			1	1		

- Molecule 4 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$).

ATP
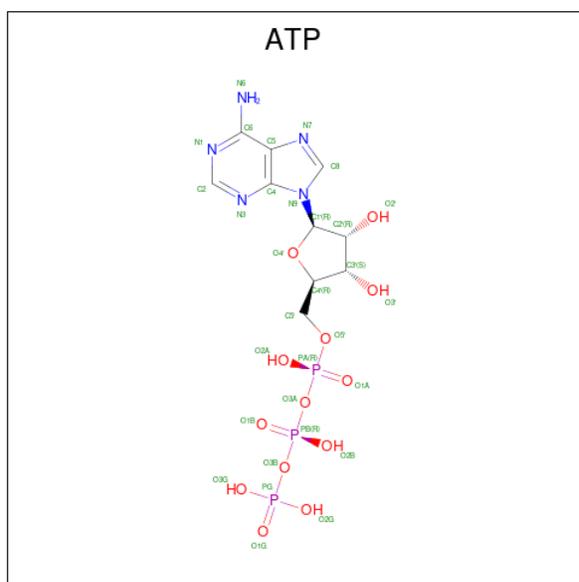
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	B	1	Total	C	N	O	P	0	0
			31	10	5	13	3		
4	C	1	Total	C	N	O	P	0	0
			31	10	5	13	3		

- Molecule 5 is water.

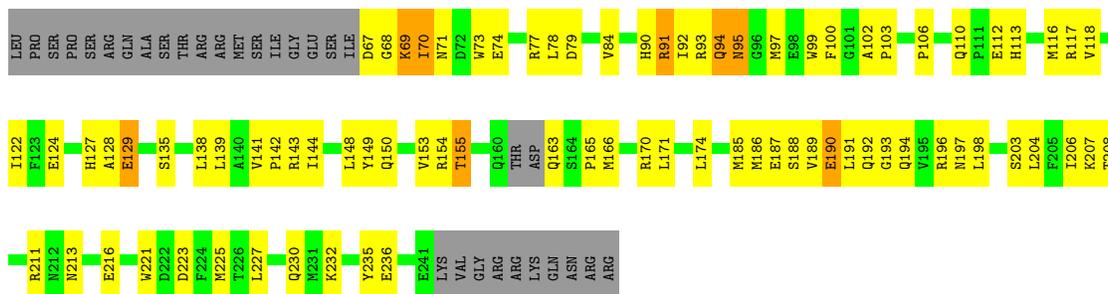| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	32	Total	O	0	0
			32	32		
5	B	145	Total	O	0	0
			145	145		
5	C	83	Total	O	0	0
			83	83		

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.
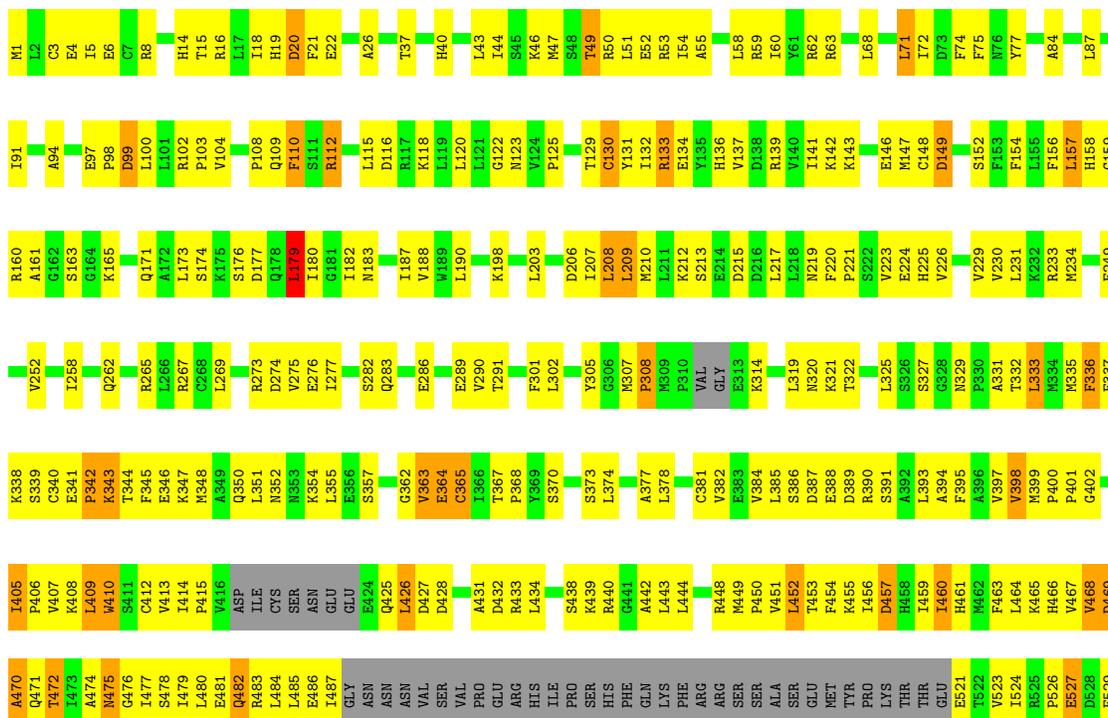
Note EDS was not executed.

- Molecule 1: Apoptosis regulator ced-9

- Molecule 2: ced-4

P530 K531 F532 M533 Q534 L535 H536 Q537 K538 F539 Y540 D541 S542 L543 LYS ASN PHE ALA CYS CYS

• Molecule 2: ced-4

Chain C: 31% 32% 5% 32%

MET LEU CYS GLU ILE GLU CYS ARG ALA ALA LEU SER THR ALA HIS THR ARG LEU ILE HIS ASP PHE GLU PRO ARG ASP ALA LEU THR LEU TYR LEU GLU GLY LYS ASN ILE PHE THR GLU ASP HIS SER GLU ILE ILE SER LYS MET SER THR ARG LEU GLU ARG ALA ASN PHE LEU ARG ILE

TYR ARG ARG GLN ALA SER GLU LEU GLY PRO LEU ILE ASP PHE PHE ASN TYR ASN ASN GLN SER HIS LEU ALA ASP PHE LEU GLU ASP TYR ILE GLU PHE ALA ILE ASN GLU PRO ASP LEU LEU ARG PRO VAL VAL ILE ALA PRO Q109 F110 S111 R112 Q113 M114 L115 D116 R117 K118 L119 L120

N123 K126 C130 R133 E134 Y135 H136 V140 I141 K142 E146 M147 F154 L155 F156 L157 H158 G159 R160 G164 K165 I168 L173 L179 D185 S186 I187 V188 W189 L190 K191 T195 A196 P197 L203 F204 T205 D206 I207 L208 L209 M210 L211 K212 D216

L217 L218 V223 E224 T227 S228 V229 K232 I235 C236 N237 A238 L239 I240 D241 R242 P243 N244 T245 L246 F249 D250 V253 Q254 E255 I258 R259 W260 A261 Q262 L266 R267 C268 L269 T272 R273 D274 V275 E276 I277 S278 N279 A280 Q283 V290 T291 S292 L293

C298 Y299 L302 Y305 G306 M307 P308 M309 P310 L319 I323 S327 G328 N329 P330 A331 T332 L333 M334 M335 F336 F337 K338 S339 C340 E341 P342 K343 T344 F345 M348 A349 Q350 N353 K354 L355 E356 V361 G362 V363 E364 C365 I366 T367 P368 Y369 L374 Q379 R380 C381

V382 E383 V384 L385 S386 D387 E388 D389 R390 S391 A392 L393 A394 F395 A396 V397 V398 M399 P400 P401 G402 V403 D404 I405 P406 V407 K408 L409 W410 S411 C412 V413 I414 D427 D428 E429 V430 A431 D432 R433 L434 K435 R436 L437 S438 K439 R440

L443 L444 K447 R448 M449 P450 V451 L452 T453 F454 K455 I456 I459 I460 H461 M462 F463 L464 V467 V468 D469 A470 Q471 T472 I473 A474 N475 G476 I477 S478 I479 L480 E481 Q482 ARG LEU LEU GLU ILE GLY ASN ASN VAL SER VAL PRO GLU ARG HIS ILE PRO SER HIS PHE GLN LYS

PRO VAL ASP ILE CYS SER ASN GLU GLU GLU GLN GLU LEU

PHE ARG ARG SER SER ALA SER GLU MET TYR PRO LYS THR THR GLU GLU THR VAL ILE ARG PRO GLU ASP PHE PRO LYS PHE M533 Q534 L535 H536 Q537 Y540 D541 S542 L543 LYS ASN PHE ALA CYS CYS

4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α, β, γ	128.90Å 128.90Å 209.93Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.00 – 2.60	Depositor
% Data completeness (in resolution range)	(Not available) (40.00-2.60)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS	Depositor
R, R_{free}	0.249 , 0.277	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	8730	wwPDB-VP
Average B, all atoms (Å^2)	82.0	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: ATP, MG

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	0.42	0/1450	0.75	3/1950 (0.2%)
2	B	0.37	0/4101	0.66	0/5540
2	C	0.35	0/3010	0.65	1/4061 (0.0%)
All	All	0.37	0/8561	0.67	4/11551 (0.0%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	68	GLY	N-CA-C	11.40	141.59	113.10
1	A	69	LYS	N-CA-C	6.55	128.70	111.00
1	A	68	GLY	CA-C-N	-5.44	105.24	117.20
2	C	134	GLU	CB-CA-C	5.31	121.03	110.40

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	1417	0	1365	85	0
2	B	4028	0	4052	335	0
2	C	2961	0	2998	241	0
3	B	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	1	0	0	0	0
4	B	31	0	12	4	0
4	C	31	0	12	3	0
5	A	32	0	0	7	0
5	B	145	0	0	22	0
5	C	83	0	0	16	0
All	All	8730	0	8439	633	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 37.

The worst 5 of 633 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:B:302:LEU:HA	2:B:337:PHE:HZ	1.05	1.11
2:C:332:THR:HA	2:C:335:MET:HE3	1.15	1.07
2:C:433:ARG:HH11	2:C:433:ARG:HB2	1.17	1.05
2:C:307:MET:HG3	2:C:308:PRO:HD2	1.36	1.04
2:B:49:THR:HG22	2:B:52:GLU:H	1.22	1.01

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 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	169/204 (83%)	144 (85%)	18 (11%)	7 (4%)	3	3
2	B	493/549 (90%)	430 (87%)	46 (9%)	17 (3%)	3	5
2	C	367/549 (67%)	315 (86%)	36 (10%)	16 (4%)	2	3
All	All	1029/1302 (79%)	889 (86%)	100 (10%)	40 (4%)	3	4

5 of 40 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	470	ALA
2	C	342	PRO
2	C	343	LYS
2	C	450	PRO
2	C	470	ALA

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 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	151/179 (84%)	142 (94%)	9 (6%)	19	39
2	B	457/501 (91%)	415 (91%)	42 (9%)	9	17
2	C	338/501 (68%)	312 (92%)	26 (8%)	13	25
All	All	946/1181 (80%)	869 (92%)	77 (8%)	11	23

5 of 77 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	C	208	LEU
2	C	433	ARG
2	C	217	LEU
2	C	374	LEU
2	C	537	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 35 such sidechains are listed below:

Mol	Chain	Res	Type
2	C	254	GLN
2	C	350	GLN
2	C	482	GLN
2	B	136	HIS
2	B	127	GLN

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 ⓘ

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 for Mogul analysis.

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	ATP	B	551	3	26,33,33	2.53	5 (19%)	31,52,52	2.12	10 (32%)
4	ATP	C	551	3	26,33,33	1.73	6 (23%)	31,52,52	1.81	7 (22%)

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	ATP	B	551	3	-	3/18/38/38	0/3/3/3
4	ATP	C	551	3	-	2/18/38/38	0/3/3/3

The worst 5 of 11 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	551	ATP	O4'-C1'	9.90	1.54	1.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	C	551	ATP	O4'-C1'	4.70	1.47	1.41
4	B	551	ATP	C4-N3	4.34	1.41	1.35
4	B	551	ATP	C2-N3	4.29	1.39	1.32
4	C	551	ATP	C2-N3	4.11	1.38	1.32

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	B	551	ATP	PA-O3A-PB	-5.93	112.46	132.83
4	C	551	ATP	O4'-C1'-C2'	-5.08	99.50	106.93
4	B	551	ATP	PB-O3B-PG	-4.73	116.60	132.83
4	C	551	ATP	PB-O3B-PG	-3.74	120.00	132.83
4	C	551	ATP	C4-C5-N7	3.33	112.87	109.40

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	551	ATP	C4'-C5'-O5'-PA
4	C	551	ATP	C5'-O5'-PA-O2A
4	C	551	ATP	C5'-O5'-PA-O3A
4	B	551	ATP	PA-O3A-PB-O1B
4	B	551	ATP	PA-O3A-PB-O2B

There are no ring outliers.

2 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	551	ATP	4	0
4	C	551	ATP	3	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 ATP B 551

Ligand ATP C 551

Bond lengths

Bond angles

Torsions

Rings
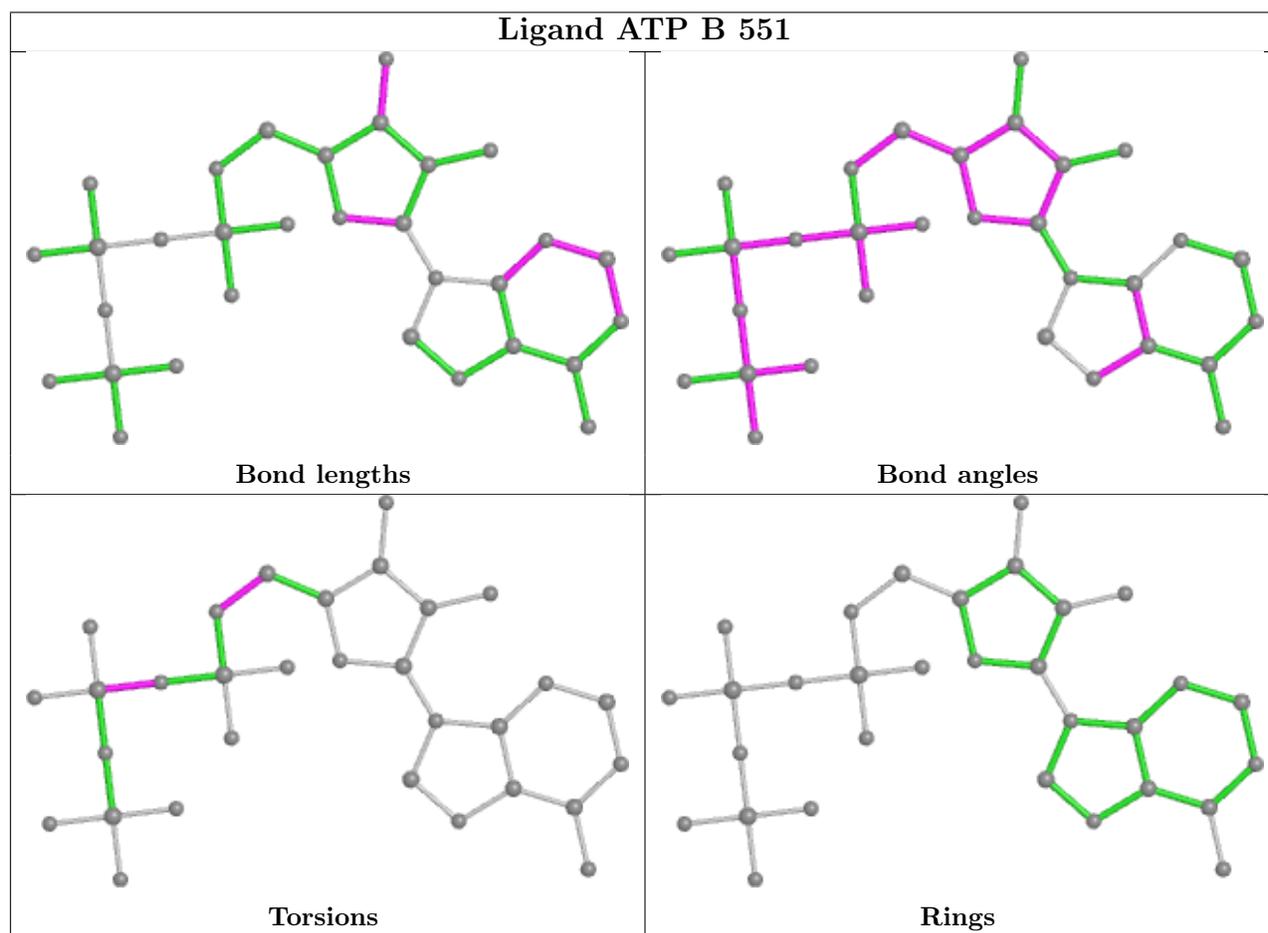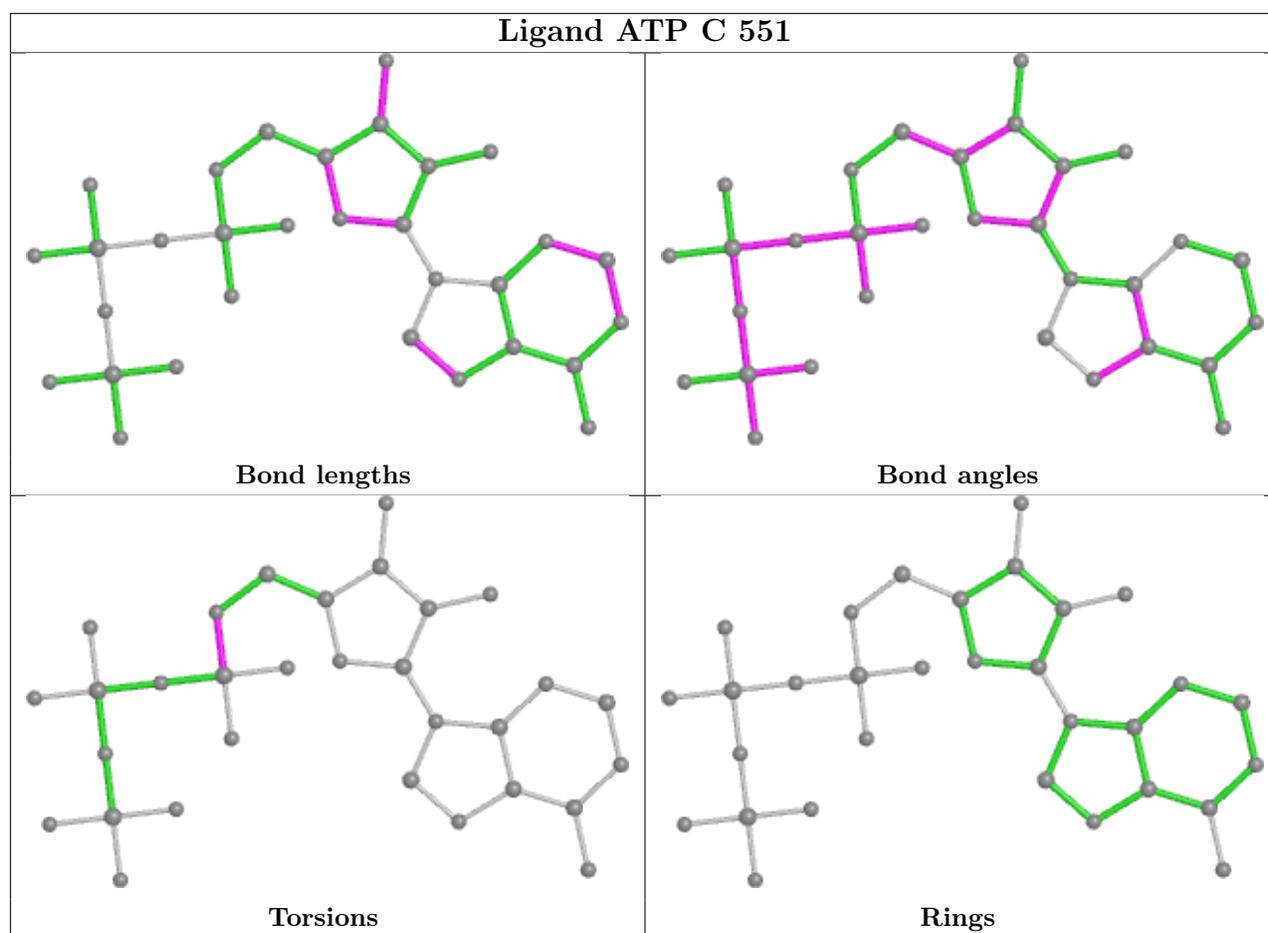
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6   Fit of model and data ⓘ

6.1   Protein, DNA and RNA chains ⓘ

EDS was not executed - this section is therefore empty.

6.2   Non-standard residues in protein, DNA, RNA chains ⓘ

EDS was not executed - this section is therefore empty.

6.3   Carbohydrates ⓘ

EDS was not executed - this section is therefore empty.

6.4   Ligands ⓘ

EDS was not executed - this section is therefore empty.

6.5   Other polymers ⓘ

EDS was not executed - this section is therefore empty.