



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 10, 2026 – 01:30 PM UTC

PDB ID : 1O1R / pdb_00001o1r
Title : Structure of FPT bound to GGPP
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Deposited on : 2003-01-14
Resolution : 2.30 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at 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>.

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

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

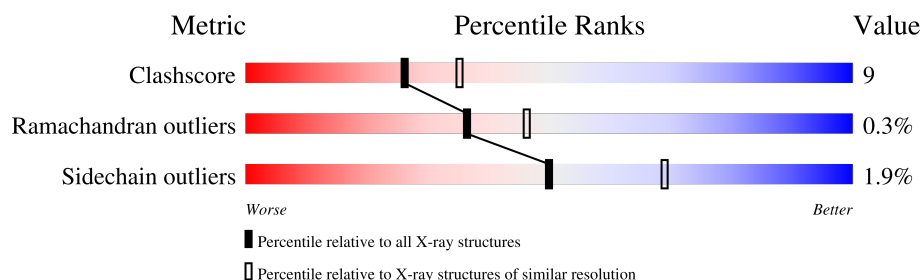
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	380	 61% 20% • 17%
2	B	427	 67% 25% • 6%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 6604 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 Protein farnesyltransferase alpha subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	315	Total	C	N	O	S	0	0	0
			2680	1706	470	499	5			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	cloning artifact	UNP Q04631
A	-1	SER	-	cloning artifact	UNP Q04631
A	0	HIS	-	cloning artifact	UNP Q04631
A	156	THR	ILE	conflict	UNP Q04631

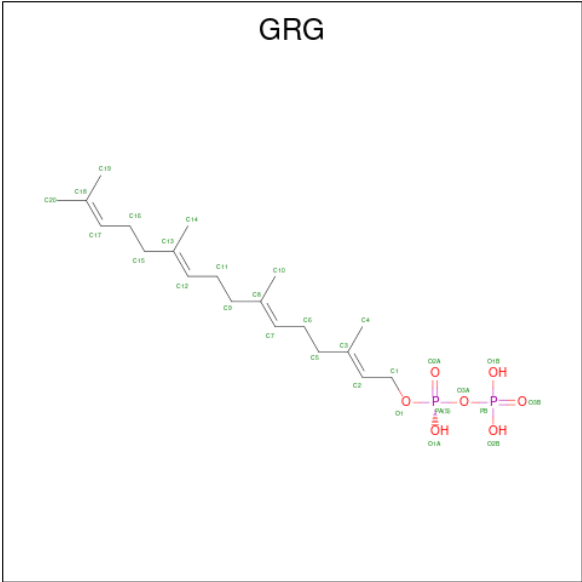
- Molecule 2 is a protein called Protein farnesyltransferase beta subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	401	Total	C	N	O	S	0	0	0
			3153	2016	543	571	23			

- Molecule 3 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	Zn	0	0
			1	1		

- Molecule 4 is GERANYLGERANYL DIPHOSPHATE (CCD ID: GRG) (formula: C₂₀H₃₆O₇P₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	B	1	Total	C	O	P	0	0
			29	20	7	2		

- Molecule 5 is water.

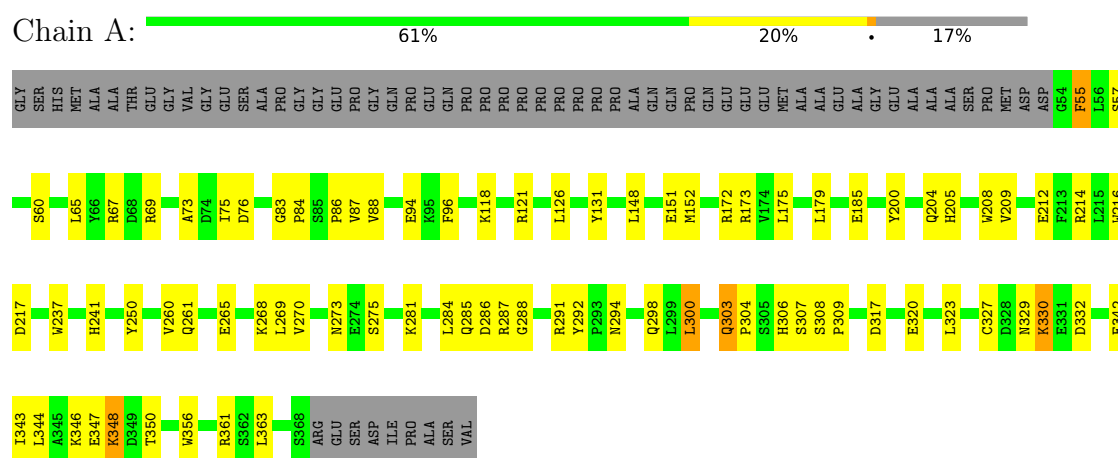
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	361	Total	O	0	0
			361	361		
5	B	380	Total	O	0	0
			380	380		

3 Residue-property plots

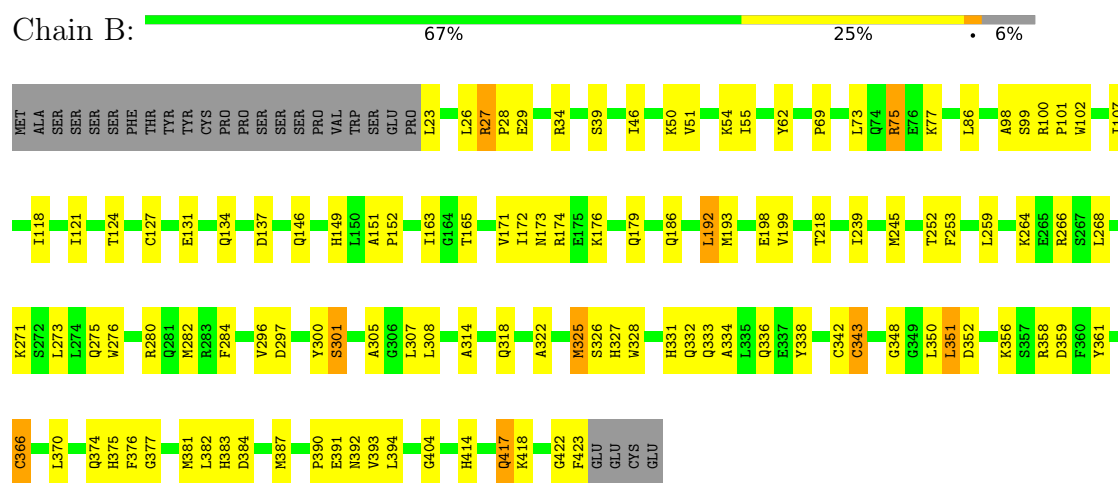
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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: Protein farnesyltransferase alpha subunit



• Molecule 2: Protein farnesyltransferase beta subunit



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 61	Depositor
Cell constants a, b, c, α , β , γ	171.65Å 171.65Å 69.08Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	8.00 – 2.30	Depositor
% Data completeness (in resolution range)	(Not available) (8.00-2.30)	Depositor
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, R_{free}	0.177 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	6604	wwPDB-VP
Average B, all atoms (Å ²)	44.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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

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	0.58	0/2746	1.03	15/3728 (0.4%)
2	B	0.58	0/3238	1.03	22/4397 (0.5%)
All	All	0.58	0/5984	1.03	37/8125 (0.5%)

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	A	0	1

There are no bond length outliers.

All (37) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	217	ASP	N-CA-C	9.26	122.53	111.33
1	A	185	GLU	N-CA-C	8.71	121.65	111.02
2	B	343	CYS	N-CA-C	6.85	120.95	112.59
1	A	348	LYS	N-CA-C	6.82	119.73	111.82
2	B	351	LEU	N-CA-C	6.59	118.78	108.96
2	B	375	HIS	N-CA-C	6.51	119.35	108.73
2	B	342	CYS	N-CA-C	6.16	121.07	113.50
2	B	27	ARG	CA-C-N	6.15	125.88	119.05
2	B	27	ARG	C-N-CA	6.15	125.88	119.05
1	A	270	VAL	CA-C-N	6.11	127.48	119.84
1	A	270	VAL	C-N-CA	6.11	127.48	119.84
1	A	73	ALA	N-CA-C	5.75	119.11	111.75
1	A	216	TRP	N-CA-C	5.65	119.35	112.23
2	B	404	GLY	CA-C-N	5.57	125.67	119.32

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	404	GLY	C-N-CA	5.57	125.67	119.32
2	B	327	HIS	N-CA-C	5.52	117.79	109.23
1	A	350	THR	N-CA-C	5.51	119.11	112.38
2	B	192	LEU	N-CA-C	-5.48	103.15	110.55
2	B	417	GLN	N-CA-C	-5.47	105.48	111.82
1	A	55	PHE	N-CA-C	5.46	118.28	108.17
2	B	366	CYS	N-CA-C	-5.42	105.45	111.36
2	B	174	ARG	N-CA-C	5.37	117.89	111.71
2	B	186	GLN	CA-C-N	5.33	124.97	119.05
2	B	186	GLN	C-N-CA	5.33	124.97	119.05
2	B	301	SER	N-CA-C	-5.33	105.58	111.71
1	A	75	ILE	N-CA-C	5.33	116.45	109.21
2	B	172	ILE	N-CA-C	5.28	115.20	108.12
2	B	218	THR	CA-C-N	5.22	125.53	119.47
2	B	218	THR	C-N-CA	5.22	125.53	119.47
1	A	292	TYR	CA-C-N	5.18	124.81	119.05
1	A	292	TYR	C-N-CA	5.18	124.81	119.05
2	B	100	ARG	CA-C-N	-5.18	114.28	119.56
2	B	100	ARG	C-N-CA	-5.18	114.28	119.56
1	A	307	SER	N-CA-C	5.17	117.85	107.41
1	A	330	LYS	N-CA-C	5.14	116.88	111.28
1	A	347	GLU	N-CA-C	5.14	121.74	110.80
2	B	75	ARG	N-CA-C	5.06	117.46	111.33

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	131	TYR	Sidechain

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	A	2680	0	2600	41	0
2	B	3153	0	3085	68	0
3	B	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	29	0	33	3	0
5	A	361	0	0	7	0
5	B	380	0	0	5	0
All	All	6604	0	5718	109	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 (109) 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:374:GLN:HE22	2:B:394:LEU:H	1.29	0.81
1:A:287:ARG:HB3	1:A:291:ARG:HD3	1.63	0.78
2:B:73:LEU:H	2:B:392:ASN:HD21	1.34	0.76
1:A:281:LYS:O	1:A:285:GLN:HB2	1.86	0.75
5:A:671:HOH:O	2:B:275:GLN:HG2	1.89	0.72
2:B:137:ASP:HA	2:B:176:LYS:HE2	1.72	0.72
2:B:301:SER:O	2:B:305:ALA:HB3	1.89	0.71
1:A:173:ARG:HD2	5:A:623:HOH:O	1.96	0.66
2:B:73:LEU:H	2:B:392:ASN:ND2	1.94	0.65
2:B:198:GLU:HA	5:B:2284:HOH:O	1.95	0.65
1:A:261:GLN:O	1:A:265:GLU:HG2	1.97	0.63
2:B:338:TYR:CE2	2:B:343:CYS:SG	2.92	0.63
1:A:300:LEU:O	1:A:303:GLN:HB2	2.00	0.62
2:B:325:MET:HE2	2:B:381:MET:HG3	1.81	0.62
1:A:287:ARG:HB3	1:A:291:ARG:CD	2.32	0.60
1:A:96:PHE:HA	1:A:126:LEU:HD13	1.85	0.59
2:B:134:GLN:HE22	2:B:173:ASN:H	1.50	0.59
2:B:264:LYS:HE2	5:B:2108:HOH:O	2.02	0.58
2:B:326:SER:HB2	2:B:383:HIS:CD2	2.39	0.58
2:B:331:HIS:CD2	2:B:334:ALA:H	2.22	0.58
2:B:336:GLN:HG2	2:B:370:LEU:HD12	1.86	0.57
2:B:34:ARG:HD3	2:B:284:PHE:CZ	2.39	0.57
2:B:131:GLU:HG2	2:B:171:VAL:HG13	1.86	0.56
1:A:200:TYR:HB3	4:B:2001:GRG:HC52	1.87	0.56
1:A:148:LEU:HB2	1:A:179:LEU:HD21	1.87	0.56
2:B:34:ARG:HD3	2:B:284:PHE:CE1	2.40	0.56
1:A:273:ASN:HB3	5:A:534:HOH:O	2.05	0.55
2:B:62:TYR:HB2	5:B:2216:HOH:O	2.07	0.55
2:B:51:VAL:O	2:B:55:ILE:HG12	2.08	0.54
2:B:333:GLN:HG3	2:B:387:MET:SD	2.47	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:163:ILE:HG22	2:B:165:THR:HG23	1.90	0.54
2:B:62:TYR:CD2	2:B:69:PRO:HA	2.44	0.53
2:B:381:MET:O	2:B:382:LEU:HD22	2.09	0.53
2:B:328:TRP:H	2:B:332:GLN:NE2	2.07	0.53
2:B:422:GLY:O	2:B:423:PHE:HB2	2.09	0.52
2:B:176:LYS:NZ	2:B:179:GLN:HE22	2.08	0.52
2:B:23:LEU:HD12	2:B:26:LEU:HD22	1.92	0.52
2:B:297:ASP:HB3	2:B:300:TYR:CD1	2.45	0.51
1:A:55:PHE:CZ	1:A:118:LYS:HG2	2.45	0.51
2:B:359:ASP:OD1	2:B:361:TYR:HB3	2.11	0.51
2:B:137:ASP:HA	2:B:176:LYS:CE	2.40	0.51
1:A:208:TRP:CE2	1:A:212:GLU:HG3	2.46	0.51
2:B:239:ILE:HB	2:B:252:THR:HA	1.94	0.50
2:B:121:ILE:O	2:B:124:THR:HG22	2.12	0.49
1:A:55:PHE:CE2	1:A:121:ARG:HD3	2.47	0.49
1:A:344:LEU:HD13	1:A:356:TRP:CE2	2.47	0.49
1:A:317:ASP:HA	1:A:320:GLU:OE2	2.13	0.49
2:B:46:ILE:O	2:B:50:LYS:HG3	2.13	0.48
1:A:65:LEU:O	1:A:69:ARG:HG3	2.12	0.48
2:B:98:ALA:HA	2:B:146:GLN:HE22	1.80	0.47
2:B:192:LEU:HD23	2:B:199:VAL:CG2	2.45	0.47
2:B:86:LEU:HB2	2:B:107:ILE:HG21	1.97	0.47
2:B:350:LEU:HD22	2:B:366:CYS:HB3	1.97	0.47
2:B:374:GLN:O	2:B:384:ASP:HA	2.15	0.47
2:B:390:PRO:HG2	2:B:391:GLU:OE2	2.15	0.47
1:A:288:GLY:HA3	5:A:582:HOH:O	2.14	0.47
1:A:57:SER:HB3	1:A:60:SER:HB2	1.97	0.46
1:A:237:TRP:CD1	1:A:275:SER:HB3	2.51	0.46
1:A:204:GLN:HB2	2:B:245:MET:HE2	1.98	0.46
1:A:173:ARG:NH1	5:A:623:HOH:O	2.36	0.46
2:B:381:MET:C	2:B:382:LEU:HD22	2.39	0.46
1:A:342:GLU:O	1:A:346:LYS:HB2	2.16	0.46
2:B:127:CYS:O	2:B:131:GLU:HG3	2.15	0.46
2:B:418:LYS:HD2	2:B:418:LYS:N	2.30	0.46
2:B:376:PHE:CD2	2:B:376:PHE:C	2.95	0.45
1:A:265:GLU:O	1:A:269:LEU:HG	2.15	0.45
2:B:149:HIS:CE1	2:B:193:MET:HE3	2.52	0.45
1:A:260:VAL:HG21	1:A:284:LEU:HD21	1.98	0.45
2:B:282:MET:HG3	2:B:296:VAL:HB	1.98	0.45
4:B:2001:GRG:H141	4:B:2001:GRG:H112	1.63	0.45
2:B:259:LEU:HD12	2:B:268:LEU:HD11	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:331:HIS:HD2	2:B:334:ALA:H	1.63	0.44
1:A:87:VAL:O	1:A:88:VAL:C	2.61	0.44
2:B:27:ARG:HA	2:B:28:PRO:HD3	1.83	0.44
2:B:314:ALA:O	2:B:318:GLN:HG3	2.17	0.44
1:A:327:CYS:O	1:A:330:LYS:HG3	2.18	0.44
2:B:348:GLY:O	2:B:358:ARG:HD2	2.18	0.44
1:A:329:ASN:HB3	1:A:332:ASP:HB3	1.99	0.44
2:B:176:LYS:HZ2	2:B:179:GLN:HE22	1.66	0.44
1:A:84:PRO:C	1:A:86:PRO:HD3	2.43	0.43
1:A:294:ASN:O	1:A:298:GLN:HG3	2.16	0.43
2:B:118:ILE:HG12	5:B:2263:HOH:O	2.17	0.43
2:B:99:SER:O	2:B:102:TRP:HB2	2.18	0.43
2:B:376:PHE:CD2	2:B:377:GLY:N	2.87	0.43
4:B:2001:GRG:HC62	4:B:2001:GRG:H101	1.68	0.43
1:A:83:GLY:HA3	5:A:735:HOH:O	2.18	0.43
1:A:205:HIS:O	1:A:209:VAL:HG23	2.19	0.43
1:A:363:LEU:HD12	1:A:363:LEU:HA	1.88	0.43
2:B:54:LYS:HE3	5:B:2354:HOH:O	2.19	0.42
2:B:149:HIS:HE1	2:B:193:MET:HE3	1.83	0.42
1:A:308:SER:HB2	1:A:309:PRO:HD2	2.01	0.42
1:A:67:ARG:HH22	1:A:94:GLU:CD	2.28	0.42
2:B:271:LYS:HD3	2:B:271:LYS:HA	1.77	0.42
2:B:73:LEU:N	2:B:392:ASN:HD21	2.11	0.41
2:B:352:ASP:HB3	2:B:356:LYS:HG3	2.01	0.41
2:B:253:PHE:HA	2:B:307:LEU:HD21	2.01	0.41
1:A:361:ARG:HB3	2:B:322:ALA:HB1	2.02	0.41
2:B:414:HIS:O	2:B:417:GLN:HG3	2.20	0.41
1:A:241:HIS:HA	1:A:250:TYR:OH	2.19	0.41
1:A:55:PHE:HD2	5:A:491:HOH:O	2.04	0.41
1:A:268:LYS:HA	1:A:306:HIS:CD2	2.56	0.41
1:A:343:ILE:HG22	1:A:348:LYS:HG2	2.03	0.41
2:B:77:LYS:HD3	2:B:77:LYS:HA	1.66	0.40
2:B:29:GLU:H	2:B:29:GLU:CD	2.28	0.40
2:B:151:ALA:HB3	2:B:152:PRO:CD	2.51	0.40
1:A:151:GLU:HG3	1:A:175:LEU:HD11	2.03	0.40
1:A:152:MET:HE1	1:A:172:ARG:NH2	2.37	0.40
2:B:75:ARG:NH2	2:B:393:VAL:O	2.54	0.40
2:B:276:TRP:O	2:B:280:ARG:HG2	2.21	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 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	307/380 (81%)	289 (94%)	16 (5%)	2 (1%)	18	23
2	B	376/427 (88%)	368 (98%)	8 (2%)	0	100	100
All	All	683/807 (85%)	657 (96%)	24 (4%)	2 (0%)	36	46

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	304	PRO
1	A	286	ASP

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	293/340 (86%)	288 (98%)	5 (2%)	53	72
2	B	338/363 (93%)	331 (98%)	7 (2%)	47	66
All	All	631/703 (90%)	619 (98%)	12 (2%)	50	69

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	76	ASP
1	A	214	ARG
1	A	300	LEU
1	A	303	GLN

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Mol	Chain	Res	Type
1	A	323	LEU
2	B	39	SER
2	B	101	PRO
2	B	266	ARG
2	B	273	LEU
2	B	308	LEU
2	B	325	MET
2	B	351	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (27) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	108	GLN
1	A	204	GLN
1	A	211	GLN
1	A	285	GLN
1	A	294	ASN
1	A	306	HIS
1	A	325	ASN
1	A	335	ASN
2	B	48	GLN
2	B	56	GLN
2	B	65	ASN
2	B	74	GLN
2	B	134	GLN
2	B	146	GLN
2	B	179	GLN
2	B	275	GLN
2	B	318	GLN
2	B	327	HIS
2	B	331	HIS
2	B	332	GLN
2	B	333	GLN
2	B	374	GLN
2	B	383	HIS
2	B	392	ASN
2	B	402	ASN
2	B	410	GLN
2	B	417	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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 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	GRG	B	2001	-	27,28,28	0.92	1 (3%)	33,37,37	1.38	7 (21%)

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	GRG	B	2001	-	-	9/31/31/31	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	2001	GRG	PA-O3A	-2.01	1.57	1.59

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	2001	GRG	C11-C12-C13	-3.03	120.69	127.62
4	B	2001	GRG	C6-C7-C8	-2.79	121.23	127.62
4	B	2001	GRG	O2B-PB-O3A	2.53	113.11	104.64
4	B	2001	GRG	C10-C8-C9	2.35	119.31	115.23
4	B	2001	GRG	C14-C13-C15	2.23	119.09	115.23
4	B	2001	GRG	C1-C2-C3	-2.13	122.70	126.20
4	B	2001	GRG	O1A-PA-O3A	2.02	112.73	107.27

There are no chirality outliers.

All (9) torsion outliers are listed below:

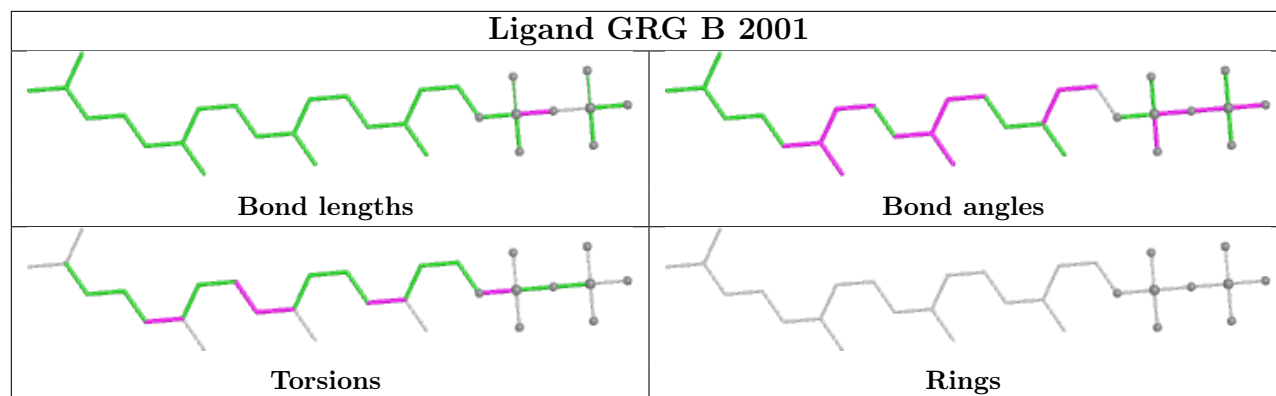
Mol	Chain	Res	Type	Atoms
4	B	2001	GRG	C1-O1-PA-O3A
4	B	2001	GRG	C1-O1-PA-O2A
4	B	2001	GRG	C10-C8-C9-C11
4	B	2001	GRG	C7-C8-C9-C11
4	B	2001	GRG	C4-C3-C5-C6
4	B	2001	GRG	C2-C3-C5-C6
4	B	2001	GRG	C12-C11-C9-C8
4	B	2001	GRG	C14-C13-C15-C16
4	B	2001	GRG	C12-C13-C15-C16

There are no ring outliers.

1 monomer is involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	2001	GRG	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 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.

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.