



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 9, 2019 – 08:20 AM EST

PDB ID : 6C5U
Title : Aminoglycoside Phosphotransferase (2'')-Ia in complex with GMPPNP, Magnesium, and Ribostamycin, Alternate form
Authors : Caldwell, S.J.; Berghuis, A.M.
Deposited on : 2018-01-16
Resolution : 2.41 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

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467
Mogul : 1.7.3 (157068), CSD as539be (2018)
Xtriage (Phenix) : 1.13
EDS : rb-20031633
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20031633

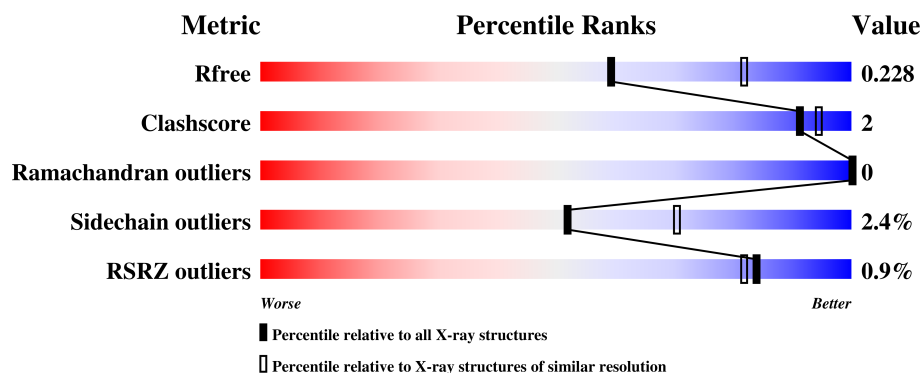
1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.41 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))
R_{free}	111664	4090 (2.44-2.40)
Clashscore	122126	4587 (2.44-2.40)
Ramachandran outliers	120053	4522 (2.44-2.40)
Sidechain outliers	120020	4523 (2.44-2.40)
RSRZ outliers	108989	3987 (2.44-2.40)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	305	<div> <div>86%</div> <div>10%</div> <div>.</div> </div>
1	B	305	<div> <div>%</div> <div>87%</div> <div>8%</div> <div>.</div> <div>.</div> </div>
1	C	305	<div> <div>87%</div> <div>7%</div> <div>6%</div> </div>
1	D	305	<div> <div>2%</div> <div>90%</div> <div>5%</div> <div>5%</div> </div>

2 Entry composition ⓘ

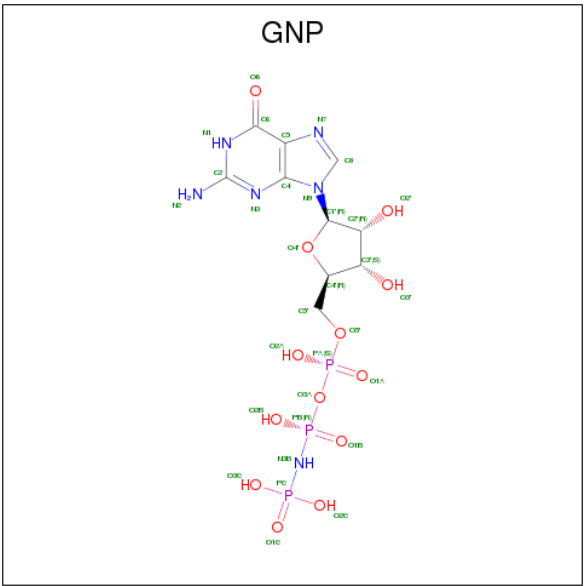
There are 6 unique types of molecules in this entry. The entry contains 10345 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Bifunctional AAC/APH.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	293	Total	C	N	O	S	0	3	0
			2424	1547	377	490	10			
1	B	292	Total	C	N	O	S	0	2	0
			2418	1546	373	489	10			
1	C	287	Total	C	N	O	S	0	2	0
			2382	1524	369	479	10			
1	D	291	Total	C	N	O	S	0	1	0
			2376	1512	372	482	10			

- Molecule 2 is PHOSPHOAMINOPHOSPHONIC ACID-GUANYLATE ESTER (three-letter code: GNP) (formula: C₁₀H₁₇N₆O₁₃P₃).



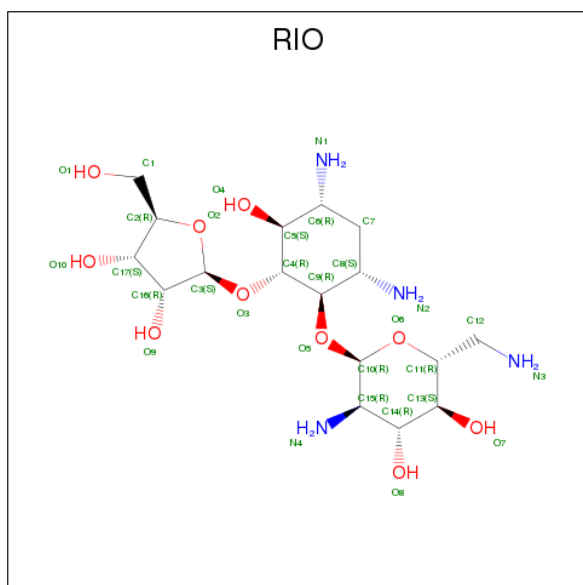
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			32	10	6	13	3		
2	B	1	Total	C	N	O	P	0	0
			32	10	6	13	3		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	C	1	Total	C	N	O	P	0	0
			32	10	6	13	3		
2	D	1	Total	C	N	O	P	0	0
			32	10	6	13	3		

- Molecule 3 is RIBOSTAMYCIN (three-letter code: RIO) (formula: $C_{17}H_{34}N_4O_{10}$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			31	17	4	10		
3	B	1	Total	C	N	O	0	0
			31	17	4	10		
3	D	1	Total	C	N	O	0	0
			31	17	4	10		

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	2	Total	Mg	0	0
			2	2		
4	A	2	Total	Mg	0	0
			2	2		
4	D	2	Total	Mg	0	0
			2	2		
4	C	2	Total	Mg	0	0
			2	2		

- Molecule 5 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	B	1	Total 1	Cl 1	0	0
5	A	1	Total 1	Cl 1	0	0
5	C	1	Total 1	Cl 1	0	0

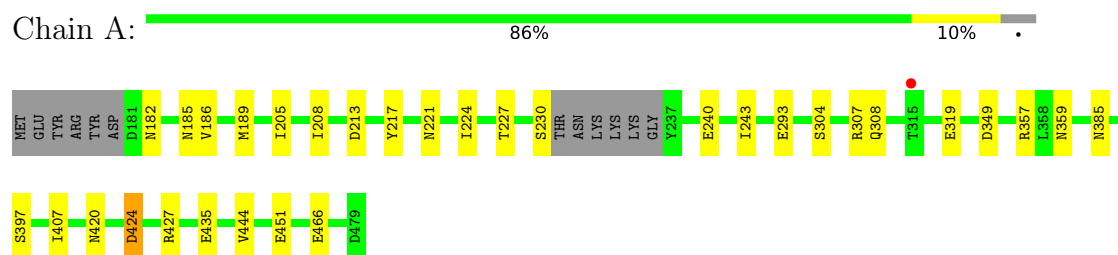
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	144	Total 144	O 144	0	0
6	B	167	Total 167	O 167	0	0
6	C	124	Total 124	O 124	0	0
6	D	78	Total 78	O 78	0	0

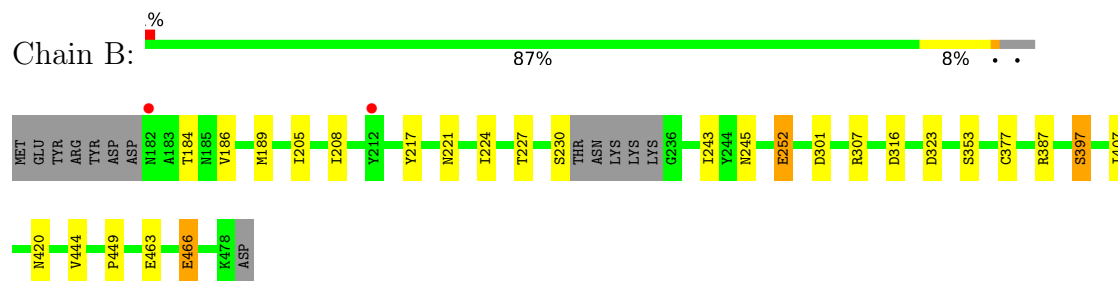
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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.

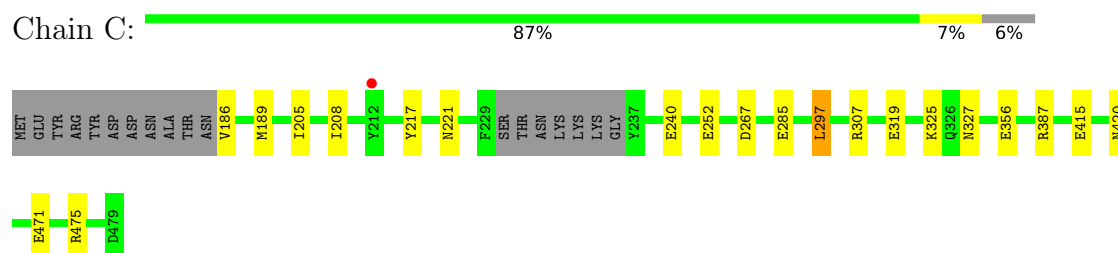
• Molecule 1: Bifunctional AAC/APH



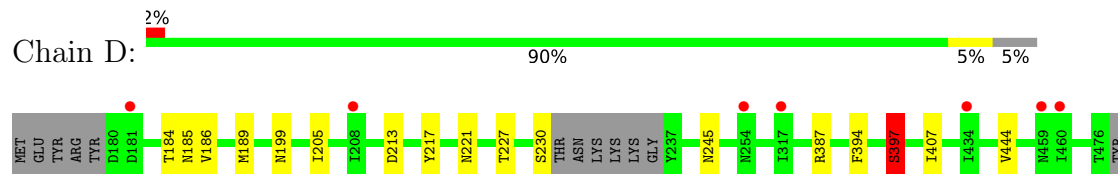
• Molecule 1: Bifunctional AAC/APH



• Molecule 1: Bifunctional AAC/APH



• Molecule 1: Bifunctional AAC/APH



LVS
ASP

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	90.25Å 100.28Å 94.04Å 90.00° 105.29° 90.00°	Depositor
Resolution (Å)	90.71 – 2.41 87.05 – 2.42	Depositor EDS
% Data completeness (in resolution range)	99.9 (90.71-2.41) 99.9 (87.05-2.42)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.31 (at 2.42Å)	Xtriage
Refinement program	REFMAC 5.8.0158	Depositor
R, R_{free}	0.180 , 0.227 0.185 , 0.228	Depositor DCC
R_{free} test set	3119 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	60.9	Xtriage
Anisotropy	0.139	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 45.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.020 for l,-k,h	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	10345	wwPDB-VP
Average B, all atoms (Å ²)	73.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.75% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

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: RIO, GNP, MG, CL

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	0.96	5/2475 (0.2%)	0.94	7/3338 (0.2%)
1	B	0.95	6/2467 (0.2%)	0.91	6/3326 (0.2%)
1	C	0.96	4/2431 (0.2%)	0.95	7/3278 (0.2%)
1	D	0.84	1/2419 (0.0%)	0.89	1/3264 (0.0%)
All	All	0.93	16/9792 (0.2%)	0.92	21/13206 (0.2%)

The worst 5 of 16 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	377	CYS	CB-SG	-7.00	1.70	1.82
1	B	353	SER	CB-OG	-6.70	1.33	1.42
1	C	471	GLU	CD-OE2	6.03	1.32	1.25
1	C	356	GLU	CD-OE1	5.96	1.32	1.25
1	A	385	ASN	CB-CG	-5.92	1.37	1.51

The worst 5 of 21 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	387	ARG	NE-CZ-NH1	7.11	123.86	120.30
1	A	424	ASP	CB-CG-OD1	6.63	124.26	118.30
1	C	319	GLU	OE1-CD-OE2	-6.61	115.37	123.30
1	C	307[A]	ARG	NE-CZ-NH2	-6.48	117.06	120.30
1	C	307[B]	ARG	NE-CZ-NH2	-6.48	117.06	120.30

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	A	2424	0	2333	10	1
1	B	2418	0	2333	8	0
1	C	2382	0	2292	6	0
1	D	2376	0	2267	9	0
2	A	32	0	13	1	0
2	B	32	0	13	0	0
2	C	32	0	13	0	0
2	D	32	0	13	0	0
3	A	31	0	34	0	0
3	B	31	0	34	0	0
3	D	31	0	34	0	0
4	A	2	0	0	1	0
4	B	2	0	0	0	0
4	C	2	0	0	0	0
4	D	2	0	0	0	0
5	A	1	0	0	0	0
5	B	1	0	0	1	0
5	C	1	0	0	0	0
6	A	144	0	0	4	0
6	B	167	0	0	0	0
6	C	124	0	0	4	1
6	D	78	0	0	0	0
All	All	10345	0	9379	35	1

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 2.

The worst 5 of 35 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:A:500:GNP:O2B	6:A:901:HOH:O	1.75	1.01
4:A:700:MG:MG	6:A:901:HOH:O	1.25	0.79
1:A:243:ILE:HD13	1:A:397:SER:HB2	1.81	0.62
1:D:185:ASN:ND2	1:D:217:TYR:OH	2.37	0.58
1:D:394:PHE:O	1:D:397:SER:OG	2.23	0.56

All (1) 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:A:293:GLU:OE1	6:C:1080:HOH:O[2_747]	2.14	0.06

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	292/305 (96%)	280 (96%)	12 (4%)	0	100	100
1	B	290/305 (95%)	281 (97%)	9 (3%)	0	100	100
1	C	285/305 (93%)	275 (96%)	10 (4%)	0	100	100
1	D	288/305 (94%)	277 (96%)	11 (4%)	0	100	100
All	All	1155/1220 (95%)	1113 (96%)	42 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	269/281 (96%)	262 (97%)	7 (3%)	49	68
1	B	269/281 (96%)	262 (97%)	7 (3%)	49	68
1	C	264/281 (94%)	258 (98%)	6 (2%)	53	72
1	D	261/281 (93%)	255 (98%)	6 (2%)	53	72

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	1063/1124 (95%)	1037 (98%)	26 (2%)	52 70

5 of 26 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	252	GLU
1	C	208	ILE
1	D	245	ASN
1	B	420	ASN
1	B	449	PRO

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	467	ASN
1	C	327	ASN
1	D	296	ASN
1	A	467	ASN
1	D	185	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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

Of 18 ligands modelled in this entry, 11 are monoatomic - leaving 7 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
2	GNP	A	500	4	27,34,34	3.70	9 (33%)	30,54,54	1.96	8 (26%)
3	RIO	A	600	-	32,33,33	0.51	0	45,49,49	1.11	4 (8%)
2	GNP	B	500	4	27,34,34	2.69	7 (25%)	30,54,54	2.39	8 (26%)
3	RIO	B	600	-	32,33,33	0.63	0	45,49,49	1.72	10 (22%)
2	GNP	C	500	4	27,34,34	2.51	6 (22%)	30,54,54	2.07	7 (23%)
2	GNP	D	500	4	27,34,34	2.56	8 (29%)	30,54,54	2.08	9 (30%)
3	RIO	D	600	-	32,33,33	0.49	0	45,49,49	2.26	10 (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
2	GNP	A	500	4	-	0/16/38/38	0/3/3/3
3	RIO	A	600	-	-	1/12/68/68	0/3/3/3
2	GNP	B	500	4	-	0/16/38/38	0/3/3/3
3	RIO	B	600	-	-	0/12/68/68	0/3/3/3
2	GNP	C	500	4	-	0/16/38/38	0/3/3/3
2	GNP	D	500	4	-	1/16/38/38	0/3/3/3
3	RIO	D	600	-	-	0/12/68/68	0/3/3/3

The worst 5 of 30 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	500	GNP	C5-C6	-12.17	1.31	1.52
2	A	500	GNP	C4-N9	-8.83	1.36	1.47
2	D	500	GNP	C4-N9	-8.04	1.37	1.47
2	B	500	GNP	C4-N9	-7.78	1.37	1.47
2	C	500	GNP	C4-N9	-7.19	1.38	1.47

The worst 5 of 56 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	600	RIO	O3-C3-O2	-7.99	102.78	111.43
2	B	500	GNP	O1G-PG-N3B	-5.91	102.94	111.79

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	600	RIO	O3-C4-C5	-5.29	93.05	107.27
2	D	500	GNP	C5-C6-N1	-5.28	111.98	118.27
2	C	500	GNP	C5-C6-N1	-5.13	112.16	118.27

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	500	GNP	O1G-PG-N3B-PB
3	A	600	RIO	C4-O3-C3-C16

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	500	GNP	1	0

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 [i](#)

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

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	293/305 (96%)	-0.17	1 (0%) 93 93	46, 67, 91, 143	0
1	B	292/305 (95%)	-0.07	2 (0%) 87 86	43, 63, 95, 128	0
1	C	287/305 (94%)	0.01	1 (0%) 93 93	44, 71, 106, 138	0
1	D	291/305 (95%)	-0.10	7 (2%) 59 55	62, 84, 118, 134	0
All	All	1163/1220 (95%)	-0.08	11 (0%) 84 82	43, 72, 109, 143	0

The worst 5 of 11 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	212	TYR	4.2
1	A	315	THR	3.6
1	D	208	ILE	3.0
1	D	434	ILE	2.6
1	D	460	ILE	2.6

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no carbohydrates in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	RIO	B	600	31/31	0.88	0.18	82,96,104,109	0
3	RIO	D	600	31/31	0.89	0.14	83,94,107,114	0
4	MG	A	700	1/1	0.90	0.13	87,87,87,87	0
5	CL	A	802	1/1	0.91	0.11	98,98,98,98	0
3	RIO	A	600	31/31	0.92	0.12	77,99,123,139	0
5	CL	B	802	1/1	0.93	0.12	89,89,89,89	0
5	CL	C	802	1/1	0.94	0.13	76,76,76,76	0
4	MG	C	700	1/1	0.96	0.09	76,76,76,76	0
4	MG	D	700	1/1	0.96	0.05	62,62,62,62	0
2	GNP	A	500	32/32	0.96	0.15	60,68,78,83	0
2	GNP	D	500	32/32	0.96	0.10	65,71,109,118	0
2	GNP	C	500	32/32	0.97	0.12	56,68,87,93	0
4	MG	D	702	1/1	0.97	0.07	90,90,90,90	0
4	MG	C	702	1/1	0.97	0.07	85,85,85,85	0
4	MG	B	702	1/1	0.98	0.07	73,73,73,73	0
4	MG	A	702	1/1	0.98	0.08	75,75,75,75	0
2	GNP	B	500	32/32	0.98	0.12	53,57,79,87	0
4	MG	B	700	1/1	0.99	0.12	57,57,57,57	0

6.5 Other polymers [i](#)

There are no such residues in this entry.