Full wwPDB X-ray Structure Validation Report (i)

Jan 31, 2016 – 07:06 PM GMT

PDB ID	:	1E26
Title	:	DESIGN, SYNTHESIS AND X-RAY CRYSTAL STRUCTURE OF A POTENT DUAL INHIBITOR OF THYMIDYLATE SYNTHASE AND DIHYDROFOLATE REDUCTASE AS AN ANTITUMOR AGENT.
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Deposited on	:	2000-05-17
Resolution	:	2.00 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
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

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

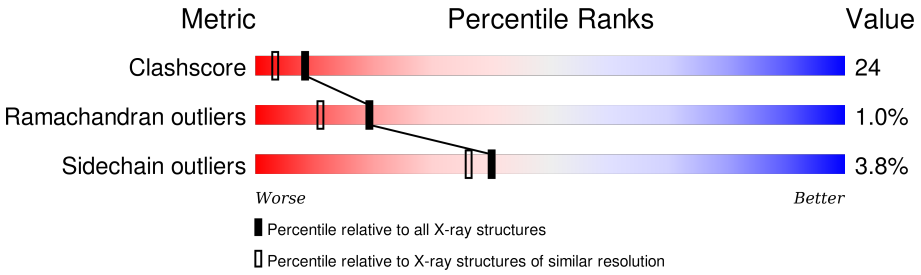
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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	102246	7340 (2.00-2.00)
Ramachandran outliers	100387	7248 (2.00-2.00)
Sidechain outliers	100360	7247 (2.00-2.00)

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 <=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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	206	63% 32% 5%

2 Entry composition

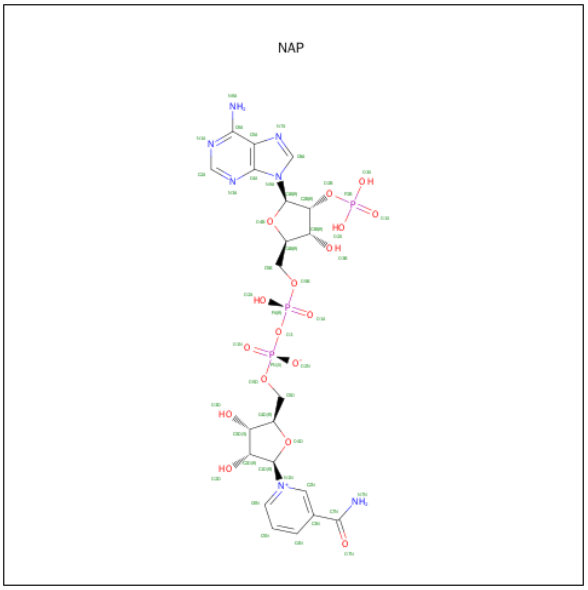
There are 4 unique types of molecules in this entry. The entry contains 1858 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 DIHYDROFOLATE REDUCTASE.

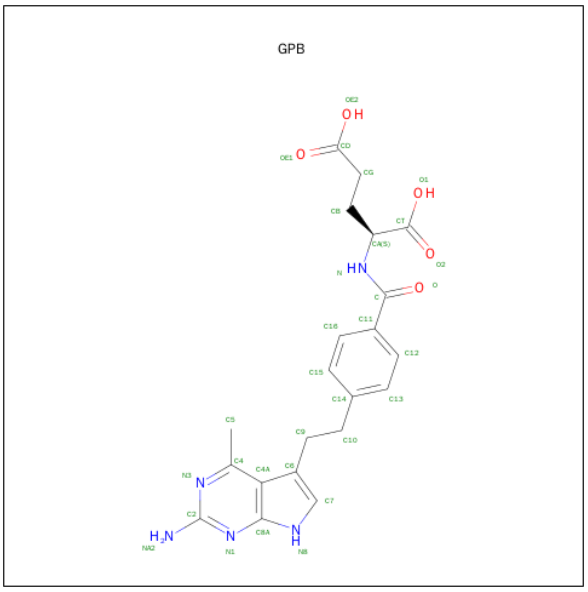
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	205	Total	C	N	O	S	0	0	0
			1678	1081	287	304	6			

- Molecule 2 is NADP NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NAP) (formula: $C_{21}H_{28}N_7O_{17}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			48	21	7	17	3		

- Molecule 3 is N-[4-[2-(2-AMINO-4-METHYL-7H-PYRROLO[2,3-D]PYRIMIDIN-5-YL)-ETHYL]-BENZOYL]GLUTAMIC ACID (three-letter code: GPB) (formula: $C_{21}H_{23}N_5O_5$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			31	21	5	5		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	101	Total	O	0	0
			101	101		

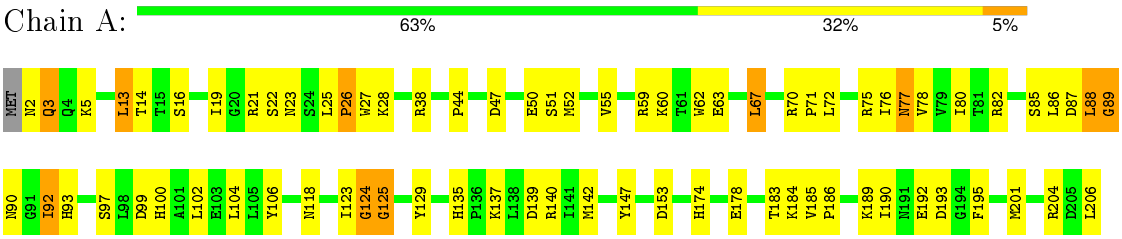
3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

Note EDS was not executed.

- Molecule 1: DIHYDROFOLATE REDUCTASE

Chain A:



4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	37.33Å 43.23Å 61.24Å 90.00° 94.59° 90.00°	Depositor
Resolution (Å)	100.00 – 2.00	Depositor
% Data completeness (in resolution range)	(Not available) (100.00-2.00)	Depositor
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS	Depositor
R, R_{free}	0.218 , 0.297	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	1858	wwPDB-VP
Average B, all atoms (Å^2)	33.0	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: NAP, GPB

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	0.49	2/1720 (0.1%)	0.69	2/2320 (0.1%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	89	GLY	CA-C	7.67	1.64	1.51
1	A	90	ASN	N-CA	5.75	1.57	1.46

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	124	GLY	N-CA-C	6.30	128.85	113.10
1	A	125	GLY	N-CA-C	-5.62	99.06	113.10

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	1678	0	1681	83	0
2	A	48	0	24	8	0
3	A	31	0	17	2	0
4	A	101	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	1858	0	1722	84	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 24.

All (84) 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:A:142:MET:SD	1:A:201:MET:HE2	2.03	0.98
1:A:67:LEU:HD12	1:A:67:LEU:H	1.29	0.97
1:A:3:GLN:HG3	1:A:137:LYS:HG3	1.51	0.90
1:A:2:ASN:ND2	1:A:99:ASP:HB3	1.87	0.89
1:A:38:ARG:NH2	1:A:183:THR:HB	1.90	0.86
1:A:135:HIS:HD2	1:A:137:LYS:H	1.27	0.81
1:A:2:ASN:HD21	1:A:99:ASP:CB	1.94	0.81
1:A:2:ASN:HD21	1:A:99:ASP:HB3	1.48	0.77
1:A:123:ILE:O	3:A:208:GPB:H7	1.83	0.77
1:A:125:GLY:HA3	2:A:207:NAP:PA	2.28	0.74
1:A:77:ASN:N	1:A:77:ASN:HD22	1.88	0.71
1:A:125:GLY:HA3	2:A:207:NAP:O1A	1.93	0.69
1:A:2:ASN:OD1	1:A:102:LEU:HB2	1.94	0.68
1:A:2:ASN:ND2	1:A:99:ASP:CB	2.55	0.68
1:A:135:HIS:CD2	1:A:137:LYS:H	2.12	0.67
1:A:5:LYS:NZ	1:A:118:ASN:O	2.19	0.66
1:A:2:ASN:HD21	1:A:99:ASP:CA	2.08	0.65
1:A:21:ARG:HB3	1:A:26:PRO:CG	2.26	0.65
1:A:71:PRO:HB3	1:A:92:ILE:HD11	1.78	0.65
1:A:88:LEU:O	1:A:92:ILE:HB	1.97	0.65
1:A:67:LEU:H	1:A:67:LEU:CD1	2.08	0.65
1:A:25:LEU:HD11	3:A:208:GPB:H101	1.81	0.61
1:A:104:LEU:C	1:A:104:LEU:HD23	2.21	0.61
1:A:124:GLY:HA3	2:A:207:NAP:H5N	1.82	0.60
1:A:183:THR:HG22	1:A:184:LYS:N	2.15	0.60
1:A:55:VAL:HG21	1:A:72:LEU:HD12	1.85	0.59
1:A:3:GLN:HG2	1:A:137:LYS:HD2	1.86	0.58
1:A:19:ILE:O	2:A:207:NAP:H2N	2.03	0.58
1:A:3:GLN:HG3	1:A:137:LYS:CG	2.30	0.58
1:A:16:SER:HB2	4:A:2005:HOH:O	2.03	0.58
1:A:21:ARG:HB3	1:A:26:PRO:HG2	1.84	0.57
1:A:87:ASP:OD1	1:A:87:ASP:O	2.22	0.57
1:A:21:ARG:HH11	1:A:21:ARG:HG2	1.68	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:186:PRO:HB2	1:A:190:ILE:HD11	1.86	0.57
1:A:147:TYR:CE2	1:A:189:LYS:HE3	2.40	0.57
1:A:28:LYS:HG3	1:A:28:LYS:O	2.04	0.56
1:A:59:ARG:O	1:A:62:TRP:HB3	2.06	0.56
1:A:62:TRP:O	1:A:70:ARG:HD3	2.06	0.56
1:A:21:ARG:HB3	1:A:26:PRO:HG3	1.88	0.54
1:A:63:GLU:HA	1:A:70:ARG:NH1	2.22	0.54
1:A:2:ASN:OD1	1:A:2:ASN:O	2.26	0.54
1:A:88:LEU:HG	1:A:89:GLY:H	1.73	0.54
1:A:47:ASP:O	1:A:51:SER:HB2	2.08	0.54
1:A:99:ASP:OD1	1:A:135:HIS:HE1	1.92	0.52
1:A:13:LEU:O	1:A:13:LEU:HD22	2.09	0.52
1:A:135:HIS:HD2	1:A:137:LYS:N	2.02	0.52
1:A:88:LEU:HG	1:A:89:GLY:N	2.24	0.52
1:A:77:ASN:N	1:A:77:ASN:ND2	2.58	0.52
1:A:124:GLY:HA2	1:A:129:TYR:CZ	2.44	0.51
1:A:44:PRO:HG2	1:A:47:ASP:HB2	1.91	0.51
1:A:38:ARG:HH21	1:A:183:THR:HB	1.71	0.50
1:A:78:VAL:HG22	1:A:93:HIS:HB2	1.93	0.50
1:A:75:ARG:O	1:A:77:ASN:ND2	2.45	0.49
1:A:139:ASP:HB3	1:A:206:LEU:HD21	1.94	0.49
1:A:50:GLU:HG2	1:A:51:SER:N	2.27	0.48
1:A:38:ARG:CZ	1:A:183:THR:HB	2.44	0.48
1:A:85:SER:O	1:A:86:LEU:HD12	2.14	0.48
1:A:21:ARG:HA	1:A:153:ASP:OD1	2.13	0.48
1:A:60:LYS:HG3	2:A:207:NAP:H4B	1.95	0.48
1:A:23:ASN:O	1:A:23:ASN:CG	2.53	0.47
1:A:50:GLU:HG2	1:A:51:SER:H	1.80	0.46
1:A:80:ILE:O	2:A:207:NAP:H1B	2.16	0.46
1:A:178:GLU:HG2	1:A:185:VAL:H	1.81	0.46
1:A:174:HIS:CE1	1:A:185:VAL:HG23	2.51	0.45
1:A:192:GLU:O	1:A:193:ASP:HB2	2.17	0.45
1:A:183:THR:HG22	1:A:184:LYS:H	1.79	0.45
1:A:77:ASN:HB2	1:A:92:ILE:CD1	2.48	0.44
1:A:21:ARG:NH1	1:A:21:ARG:HG2	2.32	0.44
1:A:13:LEU:HD22	1:A:13:LEU:C	2.38	0.44
1:A:183:THR:CG2	1:A:184:LYS:N	2.81	0.43
1:A:104:LEU:O	1:A:104:LEU:HD23	2.20	0.42
1:A:140:ARG:HD3	1:A:201:MET:HE1	2.02	0.41
1:A:3:GLN:HA	1:A:106:TYR:CE2	2.55	0.41
1:A:13:LEU:HD23	1:A:14:THR:O	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:97:SER:OG	1:A:100:HIS:HD2	2.04	0.41
1:A:22:SER:O	1:A:23:ASN:HB3	2.21	0.41
1:A:125:GLY:CA	2:A:207:NAP:PA	3.02	0.41
1:A:38:ARG:NH2	1:A:183:THR:CB	2.74	0.41
1:A:2:ASN:HD22	1:A:99:ASP:HB3	1.77	0.41
1:A:25:LEU:C	1:A:27:TRP:H	2.25	0.41
1:A:193:ASP:HB3	1:A:195:PHE:HE1	1.86	0.40
1:A:52:MET:HE3	1:A:76:ILE:HG13	2.03	0.40
1:A:3:GLN:CG	1:A:137:LYS:HD2	2.51	0.40
2:A:207:NAP:H8A	2:A:207:NAP:H52A	2.03	0.40

There are no symmetry-related clashes.

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	203/206 (98%)	189 (93%)	12 (6%)	2 (1%)	19 11

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	92	ILE
1	A	26	PRO

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	186/187 (100%)	179 (96%)	7 (4%)	40 36

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	GLN
1	A	13	LEU
1	A	67	LEU
1	A	77	ASN
1	A	82	ARG
1	A	88	LEU
1	A	204	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	2	ASN
1	A	3	GLN
1	A	4	GLN
1	A	100	HIS
1	A	135	HIS
1	A	151	HIS
1	A	187	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 carbohydrates 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	$\#\|Z\| > 2$
2	NAP	A	207	-	42,52,52	1.60	7 (16%)	54,80,80	1.93	8 (14%)
3	GPB	A	208	-	26,33,33	8.44	13 (50%)	24,46,46	4.02	11 (45%)

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	NAP	A	207	-	-	1/27/67/67	0/5/5/5
3	GPB	A	208	-	-	0/16/22/22	0/3/3/3

All (20) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	208	GPB	C5-C4	-39.32	1.25	1.50
3	A	208	GPB	C11-C	-4.17	1.41	1.50
3	A	208	GPB	C7-N8	-3.85	1.28	1.36
3	A	208	GPB	C-N	-3.64	1.26	1.34
3	A	208	GPB	C2-NA2	-3.56	1.26	1.34
3	A	208	GPB	C7-C6	-2.45	1.34	1.38
2	A	207	NAP	C5A-N7A	-2.19	1.32	1.39
2	A	207	NAP	C2A-N3A	2.00	1.35	1.32
2	A	207	NAP	C2N-C3N	2.16	1.42	1.39
2	A	207	NAP	C6N-N1N	2.59	1.42	1.35
3	A	208	GPB	C16-C15	3.62	1.45	1.38
2	A	207	NAP	O4B-C1B	3.71	1.45	1.41
3	A	208	GPB	C13-C14	3.73	1.46	1.38
3	A	208	GPB	C8A-N1	4.24	1.44	1.36
2	A	207	NAP	C3N-C7N	4.31	1.57	1.50
3	A	208	GPB	C2-N3	4.40	1.43	1.35
3	A	208	GPB	C16-C11	4.53	1.47	1.39
2	A	207	NAP	O4D-C1D	4.67	1.47	1.41
3	A	208	GPB	C4-C4A	5.25	1.51	1.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	208	GPB	C6-C4A	10.90	1.57	1.41

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	207	NAP	N3A-C2A-N1A	-9.31	121.77	128.89
3	A	208	GPB	C6-C4A-C8A	-7.65	98.58	110.09
3	A	208	GPB	N1-C2-N3	-5.89	118.47	127.44
2	A	207	NAP	O4B-C4B-C5B	-3.23	97.77	109.32
3	A	208	GPB	C16-C15-C14	-2.98	116.96	121.04
3	A	208	GPB	CB-CG-CD	-2.87	101.30	113.02
2	A	207	NAP	O4B-C1B-C2B	-2.69	101.73	106.60
3	A	208	GPB	C9-C6-C7	-2.42	123.79	127.88
3	A	208	GPB	O-C-N	-2.30	118.28	122.44
2	A	207	NAP	PN-O3-PA	-2.15	126.69	132.73
2	A	207	NAP	C3B-C2B-C1B	2.12	106.82	102.73
3	A	208	GPB	O-C-C11	2.12	124.61	120.97
3	A	208	GPB	NA2-C2-N1	2.94	123.43	117.80
2	A	207	NAP	O2B-C2B-C1B	2.97	121.60	110.02
2	A	207	NAP	O2B-C2B-C3B	3.90	126.69	111.51
2	A	207	NAP	C4A-C5A-N7A	4.07	113.22	109.48
3	A	208	GPB	C9-C10-C14	4.86	129.27	113.27
3	A	208	GPB	C2-N3-C4	9.84	125.33	117.01
3	A	208	GPB	C10-C9-C6	11.05	130.43	112.32

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	207	NAP	P2B-O2B-C2B-C3B

There are no ring outliers.

2 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	207	NAP	8	0
3	A	208	GPB	2	0

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 will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

6.3 Carbohydrates

EDS was not executed - this section will therefore be empty.

6.4 Ligands

EDS was not executed - this section will therefore be empty.

6.5 Other polymers

EDS was not executed - this section will therefore be empty.