



Full wwPDB X-ray Structure Validation Report

Feb 28, 2014 – 01:10 AM GMT

PDB ID : 2JJA
Title : CRYSTAL STRUCTURE OF GNA WITH SYNTHETIC COPPER BASE PAIR
Authors : Schlegel, M.K.; Essen, L.-O.; Meggers, E.
Deposited on : 2008-03-28
Resolution : 1.30 Å(reported)

This is a full wwPDB 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/ValidationPDFNotes.html>

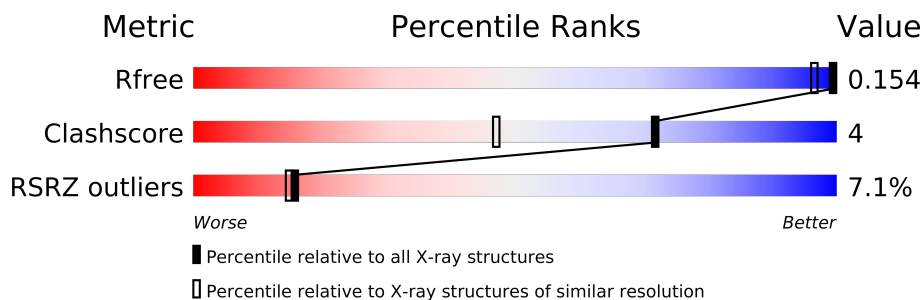
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance


The reported resolution of this entry is 1.30 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))
R_{free}	66092	1025 (1.34-1.26)
Clashscore	79885	1140 (1.34-1.26)
RSRZ outliers	66119	1025 (1.34-1.26)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	8	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 234 atoms, of which 0 are hydrogen and 0 are deuterium.

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 DNA chain called DNA (5'-D(*(ZCY)P*(ZGU)P*(ZHP)P*(ZAD)P*(ZTH)P*(ZHP)P*(ZCY)P*(ZGU))-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	8	Total	C	N	O	P	0	0	0
			136	64	25	40	7			

- Molecule 2 is COPPER (II) ION (three-letter code: CU) (formula: Cu).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Cu	0	0
			1	1		

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

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Mg	0	0
			2	2		

- Molecule 4 is COBALT HEXAMMINE(III) (three-letter code: NCO) (formula: CoH₁₈N₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	Co	N	0	0
			7	1	6		
4	A	1	Total	Co	N	0	0
			7	1	6		

- Molecule 5 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Na	0	0
			1	1		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	80	Total	O	0	0
			80	80		

3 Residue-property plots

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.

- Molecule 1: DNA (5'-D(*(ZCY)P*(ZGU)P*(ZHP)P*(ZAD)P*(ZTH)P*(ZHP)P*(ZCY)P*(ZGU))-3')

Chain A: 

There are no outlier residues recorded for this chain.

4 Data and refinement statistics

Property	Value	Source
Space group	I 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	18.16Å 48.59Å 59.87Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 1.30 9.98 – 1.30	Depositor EDS
% Data completeness (in resolution range)	99.0 (10.00-1.30) 99.0 (9.98-1.30)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.92 (at 1.30Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.124 , 0.148 0.133 , 0.154	Depositor DCC
R_{free} test set	479 reflections (7.62%)	DCC
Wilson B-factor (Å ²)	13.8	Xtriage
Anisotropy	0.301	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 51.3	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.30$	Xtriage
Outliers	3 of 6768 reflections (0.044%)	Xtriage
F_o, F_c correlation	0.98	EDS
Total number of atoms	234	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 21.03 % of the origin peak, indicating pseudo translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo translational symmetry is equal to 7.6480e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZHP, MG, ZTH, NA, ZAD, ZGU, NCO, ZCY, CU

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	$\# Z > 5$

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	2	0

There are no bond length outliers.

There are no bond angle outliers.

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	3	ZHP	C2
1	A	6	ZHP	C2

There are no planarity outliers.

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	136	0	76	0	0
2	A	1	0	0	0	0
3	A	2	0	0	0	0
4	A	14	0	0	1	1
5	A	1	0	0	0	0
6	A	80	0	0	1	1
All	All	234	0	76	1	1

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 4.

All (1) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
4:A:1005:NCO:N6	6:A:2080:HOH:O	1.67	1.24

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	Distance(Å)	Clash(Å)
4:A:1005:NCO:N1	6:A:2080:HOH:O[6_555]	1.92	0.28

5.3 Torsion angles

5.3.1 Protein backbone ⓘ

There are no protein chains in this entry.

5.3.2 Protein sidechains ⓘ

There are no protein chains in this entry.

5.3.3 RNA ⓘ

There are no RNA chains in this entry.

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

8 non-standard protein/DNA/RNA residues 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
1	ZCY	A	1	1	13,13,17	1.22	1 (7%)	14,17,24	1.94	5 (35%)
1	ZGU	A	2	1	18,20,21	1.18	2 (11%)	22,28,31	2.13	3 (13%)
1	ZHP	A	3	1,2	15,17,18	1.90	2 (13%)	18,23,26	1.85	5 (27%)
1	ZAD	A	4	1	17,19,20	1.02	2 (11%)	23,26,29	1.84	2 (8%)
1	ZTH	A	5	1	15,17,18	1.46	2 (13%)	16,23,26	2.50	2 (12%)
1	ZHP	A	6	1,2	15,17,18	1.87	5 (33%)	18,23,26	2.43	5 (27%)
1	ZCY	A	7	1	14,16,17	1.16	1 (7%)	15,21,24	1.40	3 (20%)
1	ZGU	A	8	1	18,20,21	1.27	2 (11%)	22,28,31	1.37	4 (18%)

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
1	ZCY	A	1	1	-	0/6/6/10	0/1/1/1
1	ZGU	A	2	1	-	0/7/9/10	0/0/2/2
1	ZHP	A	3	1,2	1/1/2/2	0/8/9/10	0/1/1/1
1	ZAD	A	4	1	-	1/7/9/10	0/0/2/2
1	ZTH	A	5	1	-	0/8/9/10	0/1/1/1
1	ZHP	A	6	1,2	1/1/2/2	0/8/9/10	0/1/1/1
1	ZCY	A	7	1	-	1/8/9/10	0/1/1/1
1	ZGU	A	8	1	-	1/7/9/10	0/0/2/2

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	3	ZHP	C3-C2	6.18	1.47	1.40
1	A	6	ZHP	C3-C2	4.58	1.45	1.40
1	A	7	ZCY	P-O1P	3.65	1.50	1.46
1	A	1	ZCY	C2-N1	-3.48	1.34	1.38
1	A	5	ZTH	C2-N1	-3.25	1.34	1.38
1	A	5	ZTH	P-O2P	3.12	1.50	1.46
1	A	6	ZHP	P-O2P	3.06	1.50	1.46
1	A	8	ZGU	C4-N9	-2.92	1.33	1.37

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	8	ZGU	P-O2P	2.71	1.49	1.46
1	A	4	ZAD	P-O1P	2.66	1.49	1.46
1	A	2	ZGU	C4-N9	-2.54	1.34	1.37
1	A	2	ZGU	C1G-C2G	2.50	1.54	1.51
1	A	6	ZHP	C2-N1	2.34	1.39	1.36
1	A	6	ZHP	C1G-C2G	2.28	1.53	1.51
1	A	3	ZHP	C2-N1	2.19	1.39	1.36
1	A	4	ZAD	C8-N9	-2.06	1.33	1.36
1	A	6	ZHP	O4-C4	2.04	1.26	1.23

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	5	ZTH	C6-N1-C2	-9.12	119.82	122.41
1	A	2	ZGU	C6-C5-N7	-8.47	133.00	134.14
1	A	6	ZHP	O3-C3-C2	7.76	125.34	116.44
1	A	4	ZAD	N3-C2-N1	-6.98	122.87	128.71
1	A	3	ZHP	O3-C3-C2	5.15	122.34	116.44
1	A	1	ZCY	C2-N3-C4	4.62	122.25	115.57
1	A	6	ZHP	C2M-C2-C3	-3.85	118.19	120.94
1	A	6	ZHP	C2M-C2-N1	3.37	123.80	119.63
1	A	7	ZCY	C5-C6-N1	-3.25	118.34	122.68
1	A	8	ZGU	C4-C5-N7	-3.18	106.79	109.52
1	A	4	ZAD	N3-C4-N9	3.11	131.01	125.40
1	A	8	ZGU	C6-C5-N7	-3.01	133.74	134.14
1	A	2	ZGU	C2G-C1G-N9	-2.84	108.86	112.18
1	A	8	ZGU	C6-N1-C2	2.74	124.30	119.51
1	A	3	ZHP	C2M-C2-C3	-2.61	119.08	120.94
1	A	1	ZCY	C6-C5-C4	2.54	118.52	117.47
1	A	2	ZGU	C6-N1-C2	2.53	123.94	119.51
1	A	3	ZHP	C1G-N1-C2	-2.51	117.84	121.50
1	A	1	ZCY	C5-C4-N3	-2.37	118.47	121.68
1	A	7	ZCY	C6-C5-C4	2.36	118.45	117.47
1	A	1	ZCY	C1G-N1-C6	2.33	121.75	118.00
1	A	7	ZCY	C2-N3-C4	2.31	118.91	115.57
1	A	6	ZHP	C1G-N1-C2	-2.26	118.21	121.50
1	A	3	ZHP	C2M-C2-N1	2.20	122.36	119.63
1	A	8	ZGU	C5-C4-N3	-2.14	122.83	125.94
1	A	5	ZTH	C1G-N1-C2	2.14	121.51	118.31
1	A	6	ZHP	C6-C5-C4	2.05	120.68	117.48
1	A	1	ZCY	N4-C4-N3	2.05	120.52	116.59
1	A	3	ZHP	C4-C3-C2	-2.01	117.51	120.09

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	6	ZHP	C2
1	A	3	ZHP	C2

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	4	ZAD	O2P-P-O3G-C3G
1	A	7	ZCY	O2P-P-O3G-C3G
1	A	8	ZGU	O1P-P-O3G-C3G

There are no ring outliers.

5.5 Carbohydrates

There are no carbohydrates in this entry.

5.6 Ligand geometry

Of 6 ligands modelled in this entry, 4 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	NCO	A	1004	-	6,6,6	0.62	0	0,15,15	0.00	-
4	NCO	A	1005	-	6,6,6	0.45	0	0,15,15	0.00	-

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	NCO	A	1004	-	-	0/0/0/0	0/0/0/0

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	NCO	A	1005	-	-	0/0/0/0	0/0/0/0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

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 ⓘ

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	8/8 (100%)	-0.63	0 100 100	15, 16, 20, 20	0

There are no RSRZ outliers to report.

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

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	RSR	LLDF	B-factors(Å ²)	Q<0.9
1	ZHP	A	6	17/18	0.06	-	15,17,28,30	0
1	ZAD	A	4	18/19	0.07	-	16,18,23,24	0
1	ZGU	A	8	19/20	0.06	-	13,15,16,16	0
1	ZTH	A	5	17/18	0.05	-	16,18,25,26	0
1	ZCY	A	1	13/17	0.05	-	14,15,16,16	0
1	ZHP	A	3	17/18	0.06	-	15,16,27,28	0
1	ZGU	A	2	19/20	0.05	-	12,14,17,20	0
1	ZCY	A	7	16/17	0.05	-	13,14,22,22	0

6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

6.4 Ligands

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	RSR	LLDF	B-factors(Å ²)	Q<0.9
2	CU	A	1001	1/1	0.01	-	16,16,16,16	0
3	MG	A	1003	1/1	0.05	-	24,24,24,24	1
5	NA	A	1006	1/1	0.30	-	78,78,78,78	0
4	NCO	A	1005	7/7	0.11	-	26,26,27,28	7
3	MG	A	1002	1/1	0.07	-	22,22,22,22	0
4	NCO	A	1004	7/7	0.09	-	18,20,22,22	7

6.5 Other polymers

There are no such residues in this entry.