



# Full wwPDB X-ray Structure Validation Report

Feb 27, 2014 – 11:46 PM GMT

PDB ID : 4G0A  
Title : Crystallographic Analysis of Rotavirus NSP2-RNA Complex Reveals Specific Recognition of 5'-GG Sequence for RTPase activity  
Authors : Hu, L.; Prasad, B.V.V.  
Deposited on : 2012-07-09  
Resolution : 2.10 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.  
We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)  
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

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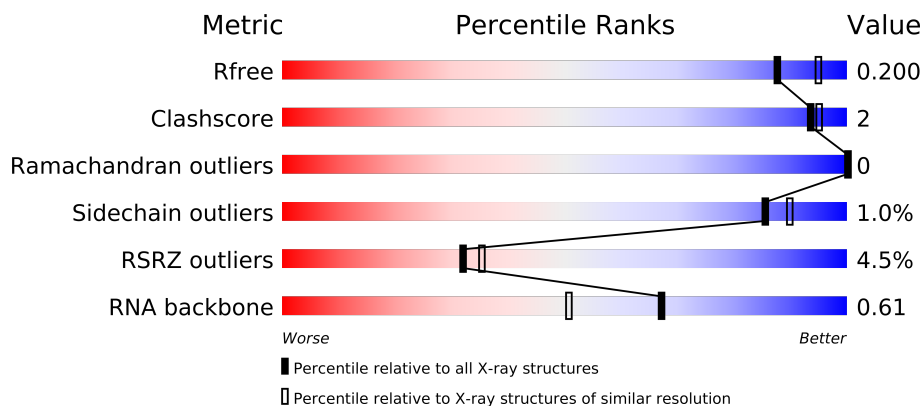
The following versions of software and data (see [references](#)) were used in the production of this report:

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 2.10 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	3012 (2.10-2.10)
Clashscore	79885	3649 (2.10-2.10)
Ramachandran outliers	78287	3610 (2.10-2.10)
Sidechain outliers	78261	3611 (2.10-2.10)
RSRZ outliers	66119	3013 (2.10-2.10)
RNA backbone	1838	1000 (2.98-1.24)

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  $\geq 3$ , 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	317	
1	B	317	
1	C	317	
1	D	317	
2	E	3	
2	F	3	
2	G	3	
2	H	3	

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 11504 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 protein called Non-structural protein 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	312	Total	C	N	O	S	0	0	0
			2537	1628	431	464	14			
1	B	312	Total	C	N	O	S	0	0	0
			2537	1628	431	464	14			
1	C	312	Total	C	N	O	S	0	0	0
			2537	1628	431	464	14			
1	D	312	Total	C	N	O	S	0	0	0
			2537	1628	431	464	14			

- Molecule 2 is a RNA chain called RNA (5'-R(P\*GP\*GP\*U)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	E	3	Total	C	N	O	P	1	0	0
			49	20	10	16	3			
2	F	3	Total	C	N	O	P	0	0	0
			49	20	10	16	3			
2	G	3	Total	C	N	O	P	0	0	0
			49	20	10	16	3			
2	H	3	Total	C	N	O	P	0	0	0
			49	20	10	16	3			

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

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

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	C	1	Total	Na	0	0
			1	1		

- Molecule 5 is water.

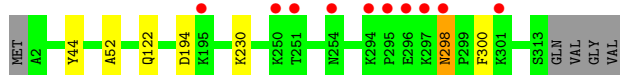
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	302	Total	O	0	0
			302	302		
5	B	270	Total	O	0	0
			270	270		
5	C	282	Total	O	0	0
			282	282		
5	D	286	Total	O	0	0
			286	286		
5	E	2	Total	O	0	0
			2	2		
5	F	3	Total	O	0	0
			3	3		
5	G	6	Total	O	0	0
			6	6		
5	H	4	Total	O	0	0
			4	4		

### 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.

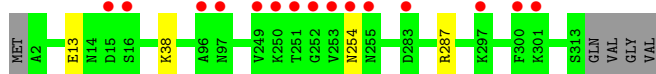
- Molecule 1: Non-structural protein 2

Chain A: 



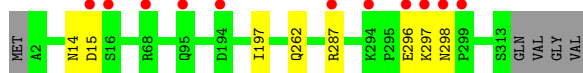
- Molecule 1: Non-structural protein 2

Chain B: 



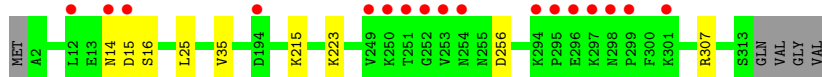
- Molecule 1: Non-structural protein 2

Chain C: 



- Molecule 1: Non-structural protein 2

Chain D: 



- Molecule 2: RNA (5'-R(P\*GP\*GP\*U)-3')

Chain E: 



- Molecule 2: RNA (5'-R(P\*GP\*GP\*U)-3')

Chain F: 



- Molecule 2: RNA (5'-R(P\*GP\*GP\*U)-3')

Chain G: 



- Molecule 2: RNA (5'-R(P\*GP\*GP\*U)-3')

Chain H: 



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	107.69Å 107.69Å 272.21Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	32.52 – 2.10 32.52 – 2.10	Depositor EDS
% Data completeness (in resolution range)	99.8 (32.52-2.10) 99.8 (32.52-2.10)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.77 (at 2.10Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.7_650)	Depositor
R, $R_{free}$	0.174 , 0.205 0.170 , 0.200	Depositor DCC
$R_{free}$ test set	5359 reflections (4.99%)	DCC
Wilson B-factor (Å <sup>2</sup> )	27.1	Xtriage
Anisotropy	0.043	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 34.3	EDS
Estimated twinning fraction	0.021 for -h,-k,l	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 107417 reflections	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	11504	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	22.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.15% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities 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: NA, 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	0.33	0/2591	0.45	1/3499 (0.0%)
1	B	0.32	0/2591	0.43	0/3499
1	C	0.35	0/2591	0.44	0/3499
1	D	0.33	0/2591	0.42	0/3499
2	E	0.14	0/54	0.40	0/82
2	F	0.16	0/54	0.40	0/82
2	G	0.17	0/54	0.42	0/82
2	H	0.17	0/54	0.42	0/82
All	All	0.33	0/10580	0.44	1/14324 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	298	ASN	C-N-CD	5.46	139.87	128.40

There are no chirality outliers.

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	2537	0	0	4	0
1	B	2537	0	0	2	0
1	C	2537	0	0	4	0
1	D	2537	0	0	7	0
2	E	49	0	22	0	0
2	F	49	0	22	0	0
2	G	49	0	22	1	0
2	H	49	0	22	2	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	C	1	0	0	0	0
5	A	302	0	0	1	0
5	B	270	0	0	2	0
5	C	282	0	0	3	0
5	D	286	0	0	4	0
5	E	2	0	0	0	0
5	F	3	0	0	0	0
5	G	6	0	0	0	0
5	H	4	0	0	0	0
All	All	11504	0	88	17	0

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 2.

All (17) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:D:307:ARG:NH1	5:D:741:HOH:O	2.37	0.58
1:D:14:ASN:N	5:D:762:HOH:O	2.40	0.55
1:C:262:GLN:NE2	5:C:639:HOH:O	2.39	0.54
2:G:1:G:H2'	2:G:2:G:H5''	1.91	0.52
1:D:223:LYS:NZ	2:H:1:G:N7	2.58	0.51
1:D:215:LYS:NZ	5:D:742:HOH:O	2.45	0.49
1:A:230:LYS:NZ	5:A:1568:HOH:O	2.49	0.46
1:B:287:ARG:NH1	5:B:1513:HOH:O	2.50	0.44
1:C:287:ARG:NH1	5:C:720:HOH:O	2.50	0.44
1:D:223:LYS:NZ	2:H:1:G:C8	2.86	0.43
1:A:300:PHE:N	1:A:300:PHE:CD1	2.86	0.43
1:D:35:VAL:N	5:D:577:HOH:O	2.51	0.42
1:C:298:ASN:N	1:C:298:ASN:OD1	2.53	0.42
1:C:197:ILE:N	5:C:778:HOH:O	2.52	0.41
1:A:122:GLN:NE2	1:D:25:LEU:N	2.68	0.41

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:254:ASN:N	5:B:1544:HOH:O	2.53	0.41
1:A:44:TYR:O	1:A:52:ALA:N	2.54	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	310/317 (98%)	304 (98%)	6 (2%)	0	100	100
1	B	310/317 (98%)	301 (97%)	9 (3%)	0	100	100
1	C	310/317 (98%)	305 (98%)	5 (2%)	0	100	100
1	D	310/317 (98%)	299 (96%)	11 (4%)	0	100	100
All	All	1240/1268 (98%)	1209 (98%)	31 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	283/287 (99%)	281 (99%)	2 (1%)	91	94
1	B	283/287 (99%)	281 (99%)	2 (1%)	91	94
1	C	283/287 (99%)	279 (99%)	4 (1%)	78	83
1	D	283/287 (99%)	280 (99%)	3 (1%)	84	88
All	All	1132/1148 (99%)	1121 (99%)	11 (1%)	85	90

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	194	ASP
1	A	298	ASN
1	B	13	GLU
1	B	38	LYS
1	C	14	ASN
1	C	15	ASP
1	C	296	GLU
1	C	297	LYS
1	D	15	ASP
1	D	16	SER
1	D	256	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	E	1/3 (33%)	0	0
2	F	1/3 (33%)	1 (100%)	0
2	G	1/3 (33%)	0	0
2	H	1/3 (33%)	0	0
All	All	4/12 (33%)	1 (25%)	0

All (1) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
2	F	2	G

There are no RNA pucker outliers to report.

## 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 5 ligands modelled in this entry, 5 are monoatomic - leaving 0 for Mogul analysis.

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	312/317 (98%)	-0.18	10 (3%) 45 50	5, 13, 46, 90	0
1	B	312/317 (98%)	0.01	15 (4%) 29 32	2, 16, 60, 95	0
1	C	312/317 (98%)	-0.01	11 (3%) 42 46	6, 17, 60, 99	0
1	D	312/317 (98%)	-0.07	17 (5%) 25 27	3, 15, 58, 102	0
2	E	3/3 (100%)	0.70	1 (33%) 1 1	25, 25, 68, 108	2 (66%)
2	F	3/3 (100%)	1.35	1 (33%) 1 1	29, 29, 82, 130	2 (66%)
2	G	3/3 (100%)	2.43	2 (66%) 0 0	36, 36, 65, 106	2 (66%)
2	H	3/3 (100%)	0.36	0 100 100	25, 25, 56, 90	2 (66%)
All	All	1260/1280 (98%)	-0.05	57 (4%) 32 35	2, 15, 60, 130	8 (0%)

All (57) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	297	LYS	5.2
1	A	295	PRO	5.2
1	C	15	ASP	5.1
1	B	253	VAL	4.9
1	B	254	ASN	4.8
1	D	254	ASN	4.6
1	D	252	GLY	4.1
1	A	294	LYS	4.0
1	D	295	PRO	3.9
1	B	297	LYS	3.9
1	B	97	ASN	3.7
1	D	297	LYS	3.7
2	G	2	G	3.6
1	B	15	ASP	3.6
1	B	251	THR	3.5
1	D	296	GLU	3.5

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Mol	Chain	Res	Type	RSRZ
1	D	15	ASP	3.4
1	C	294	LYS	3.3
1	A	195	LYS	3.3
2	G	3	U	3.3
1	C	16	SER	3.2
1	B	96	ALA	3.2
1	C	299	PRO	3.0
1	B	249	VAL	3.0
1	D	301	LYS	3.0
1	C	297	LYS	3.0
1	C	194	ASP	3.0
1	A	301	LYS	3.0
1	A	254	ASN	3.0
1	C	298	ASN	2.9
1	B	250	LYS	2.9
1	D	251	THR	2.9
1	C	68	ARG	2.9
2	F	2	G	2.9
1	D	14	ASN	2.9
1	A	298	ASN	2.8
1	D	12	LEU	2.8
1	D	298	ASN	2.8
1	D	253	VAL	2.7
1	B	301	LYS	2.6
1	A	251	THR	2.6
1	C	95	GLN	2.5
1	A	250	LYS	2.5
1	D	250	LYS	2.5
1	D	294	LYS	2.4
1	C	296	GLU	2.3
1	D	194	ASP	2.3
1	D	299	PRO	2.3
1	B	252	GLY	2.2
1	B	16	SER	2.2
1	A	296	GLU	2.2
1	B	300	PHE	2.1
1	D	249	VAL	2.1
1	B	283	ASP	2.1
2	E	2	G	2.1
1	B	255	ASN	2.0
1	C	287	ARG	2.0

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

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

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
3	CL	B	1200	1/1	0.12	-0.52	5,5,5,5	0
3	CL	D	401	1/1	0.10	-0.78	8,8,8,8	0
4	NA	C	402	1/1	0.08	-1.18	26,26,26,26	0
3	CL	C	401	1/1	0.11	-1.22	9,9,9,9	0
3	CL	A	1201	1/1	0.08	-3.09	11,11,11,11	0

## 6.5 Other polymers ⓘ

There are no such residues in this entry.