wwPDB X-ray Structure Validation Summary Report (i)

May 13, 2020 – 08:25 pm BST

PDB ID	:	5N2U
Title	:	Influenza D virus nucleoprotein
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Deposited on	:	2017-02-08
Resolution	:	2.40 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 (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

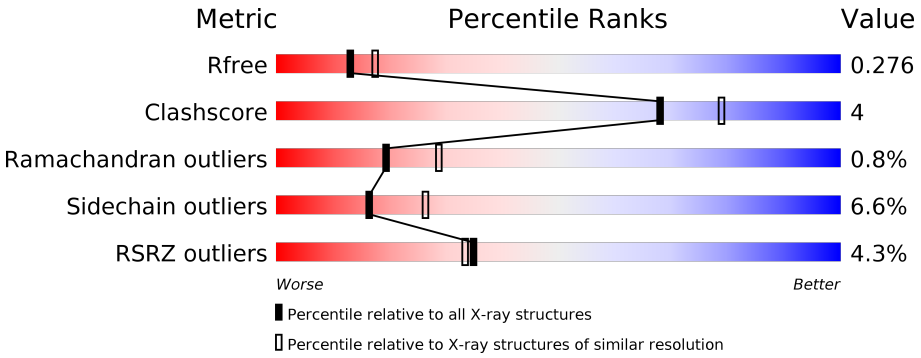
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 2.40 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}	130704	3907 (2.40-2.40)
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)
RSRZ outliers	127900	3811 (2.40-2.40)

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 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 <=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	552	5% 68% 16% • 15%
1	B	552	4% 70% 12% • 17%
1	C	552	3% 74% 9% • 15%
1	D	552	3% 75% 10% • 14%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 14881 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 Nucleoprotein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	469	Total	C	N	O	S	0	0	0
			3674	2329	635	684	26			
1	B	460	Total	C	N	O	S	0	0	0
			3591	2279	614	672	26			
1	C	467	Total	C	N	O	S	0	0	0
			3649	2314	628	681	26			
1	D	476	Total	C	N	O	S	0	0	0
			3732	2367	647	692	26			

- Molecule 2 is water.

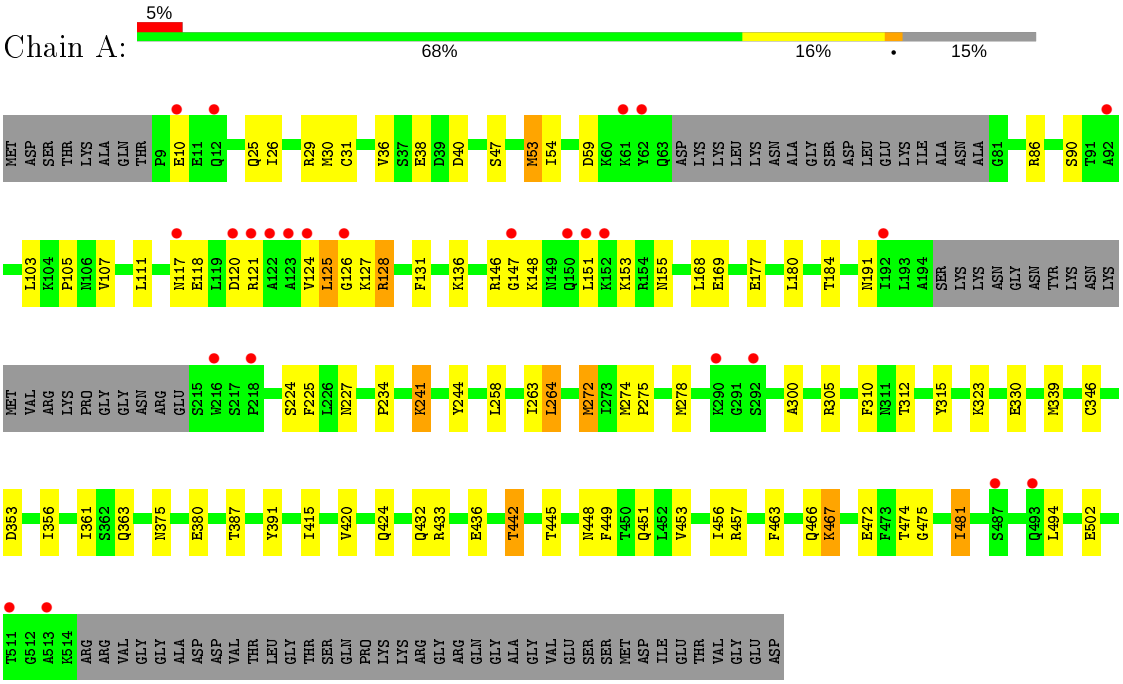
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	45	Total	O	0	0
			45	45		
2	B	56	Total	O	0	0
			56	56		
2	C	86	Total	O	0	0
			86	86		
2	D	48	Total	O	0	0
			48	48		

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.

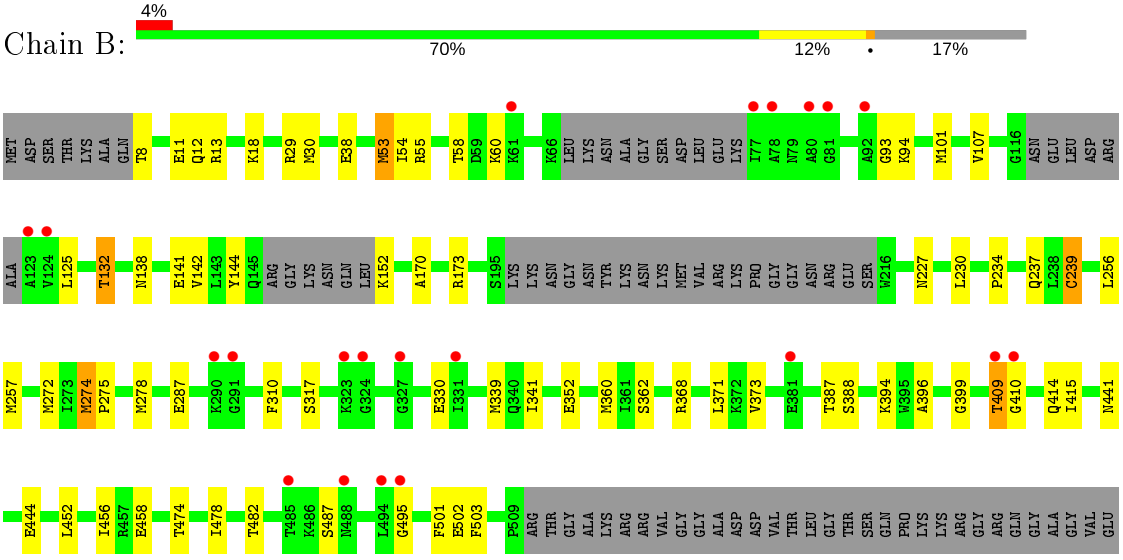
- Molecule 1: Nucleoprotein

Chain A:



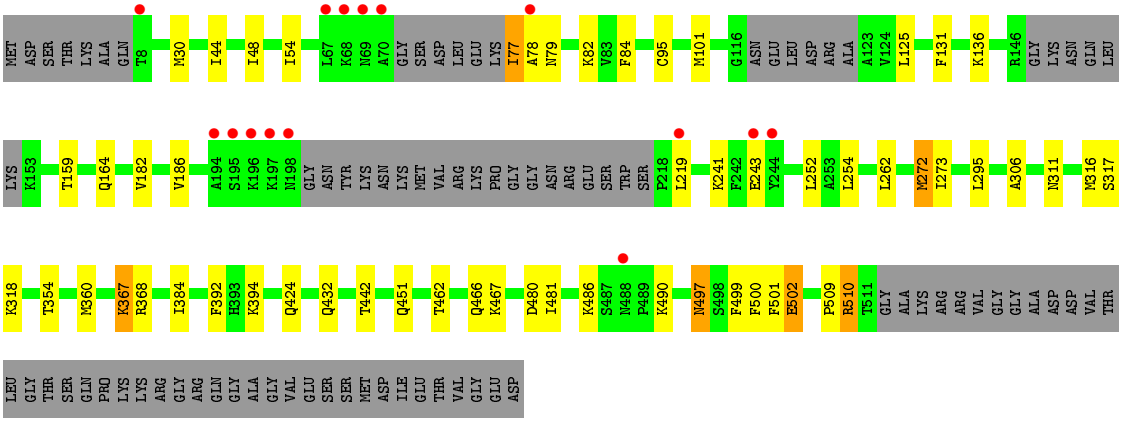
- Molecule 1: Nucleoprotein

Chain B:



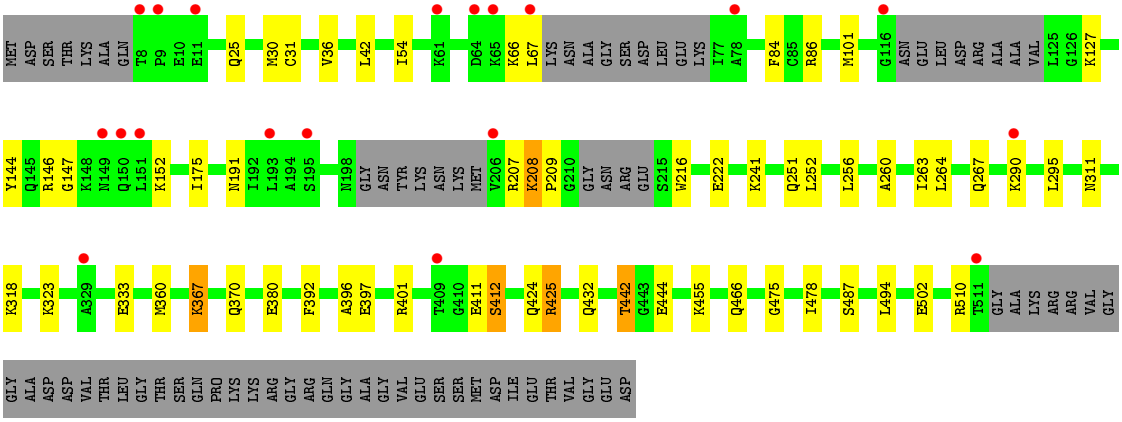
• Molecule 1: Nucleoprotein

Chain C:



• Molecule 1: Nucleoprotein

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	75.17Å 85.17Å 103.39Å 91.20° 101.94° 101.02°	Depositor
Resolution (Å)	39.71 – 2.40 39.71 – 2.40	Depositor EDS
% Data completeness (in resolution range)	91.4 (39.71-2.40) 91.4 (39.71-2.40)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.09	Depositor
$< I/\sigma(I) >$ [1]	1.44 (at 2.39Å)	Xtriage
Refinement program	BUSTER 2.10.2	Depositor
R, R_{free}	0.202 , 0.252 0.223 , 0.276	Depositor DCC
R_{free} test set	4331 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å^2)	42.8	Xtriage
Anisotropy	0.195	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 48.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	14881	wwPDB-VP
Average B, all atoms (Å^2)	55.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.61% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

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	0.47	0/3736	0.70	0/5016
1	B	0.47	0/3649	0.71	1/4898 (0.0%)
1	C	0.46	0/3708	0.67	0/4976
1	D	0.45	0/3793	0.67	0/5088
All	All	0.46	0/14886	0.69	1/19978 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	388	SER	C-N-CA	5.10	134.45	121.70

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	3674	0	3715	46	0
1	B	3591	0	3631	34	0
1	C	3649	0	3701	23	0
1	D	3732	0	3789	21	0
2	A	45	0	0	0	0
2	B	56	0	0	0	0
2	C	86	0	0	0	0
2	D	48	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	14881	0	14836	113	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 4.

The worst 5 of 113 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:125:LEU:HB3	1:A:128:ARG:HB2	1.64	0.78
1:A:274:MET:HE1	1:A:310:PHE:HA	1.70	0.74
1:A:442:THR:HG21	1:B:256:LEU:HD13	1.73	0.70
1:B:360:MET:HA	1:B:394:LYS:HB2	1.77	0.66
1:A:25:GLN:O	1:A:29:ARG:HG2	1.97	0.65

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	461/552 (84%)	429 (93%)	27 (6%)	5 (1%)	14	20
1	B	448/552 (81%)	412 (92%)	32 (7%)	4 (1%)	17	25
1	C	457/552 (83%)	440 (96%)	14 (3%)	3 (1%)	22	32
1	D	465/552 (84%)	440 (95%)	22 (5%)	3 (1%)	25	36
All	All	1831/2208 (83%)	1721 (94%)	95 (5%)	15 (1%)	19	29

5 of 15 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	147	GLY
1	A	467	LYS

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Mol	Chain	Res	Type
1	D	412	SER
1	A	59	ASP
1	B	409	THR

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	395/462 (86%)	368 (93%)	27 (7%)	16	25
1	B	388/462 (84%)	361 (93%)	27 (7%)	15	24
1	C	394/462 (85%)	372 (94%)	22 (6%)	21	34
1	D	403/462 (87%)	375 (93%)	28 (7%)	15	25
All	All	1580/1848 (86%)	1476 (93%)	104 (7%)	16	26

5 of 104 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	330	GLU
1	C	136	LYS
1	D	397	GLU
1	B	362	SER
1	B	482	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 27 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	155	ASN
1	C	414	GLN
1	D	393	HIS
1	C	311	ASN
1	A	424	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 carbohydrates in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	B	1
1	A	1
1	D	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	D	197:LYS	C	198:ASN	N	4.81
1	B	502:GLU	C	503:PHE	N	3.25
1	A	392:PHE	C	393:HIS	N	2.99

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^{th} 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	469/552 (84%)	0.29	25 (5%)	26	25	36, 55, 91, 114	0
1	B	460/552 (83%)	0.13	21 (4%)	32	31	35, 51, 81, 108	0
1	C	467/552 (84%)	0.01	15 (3%)	47	46	32, 49, 77, 103	0
1	D	476/552 (86%)	0.10	19 (3%)	38	37	33, 52, 84, 109	0
All	All	1872/2208 (84%)	0.13	80 (4%)	35	33	32, 52, 84, 114	0

The worst 5 of 80 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	122	ALA	13.0
1	A	124	VAL	9.7
1	A	147	GLY	8.5
1	A	123	ALA	7.9
1	C	67	LEU	5.9

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

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.