Full wwPDB NMR Structure Validation Report (i)

Dec 13, 2023 – 10:43 PM EST

PDB ID	:	2JQM
Title	:	Yellow Fever Envelope Protein Domain III NMR Structure (S288-K398)
Authors	:	Volk, D.E.; Gandham, S.H.; May, F.J.; Anderson, A.; Barrett, A.D.; Gorenstein, D.G.
Deposited on	:	2007-06-03

This is a Full wwPDB NMR Structure Validation 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/NMRValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

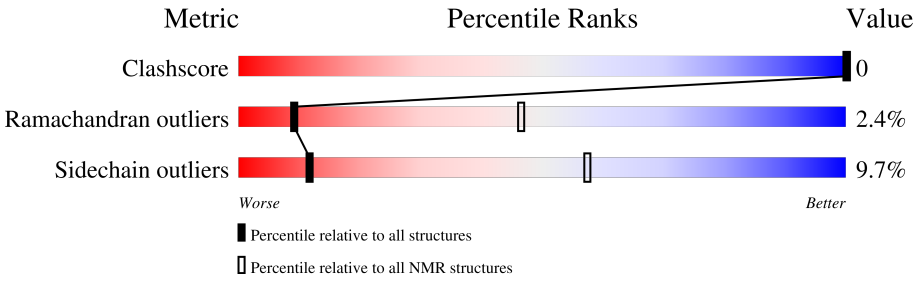
Cyrange	:	Kirchner and Güntert (2011)
NmrClust	:	Kelley et al. (1996)
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance

The following experimental techniques were used to determine the structure:
SOLUTION NMR

The overall completeness of chemical shifts assignment was not calculated.

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)	NMR archive (#Entries)
Clashscore	158937	12864
Ramachandran outliers	154571	11451
Sidechain outliers	154315	11428

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and 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%

Mol	Chain	Length	Quality of chain
1	A	112	83% 11% 6%

2 Ensemble composition and analysis (i)

This entry contains 19 models. Model 3 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *fewest violations*.

The following residues are included in the computation of the global validation metrics.

Well-defined (core) protein residues			
Well-defined core	**Residue range (total)**	**Backbone RMSD (Å)**	**Medoid model**
1	A:287-A:391 (105)	0.44	3

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

The models can be grouped into 2 clusters and 4 single-model clusters were found.

Cluster number	Models
1	1, 2, 3, 4, 5, 6, 9, 11, 12, 15, 17, 19
2	10, 14, 18
Single-model clusters	7; 8; 13; 16

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 1688 atoms, of which 853 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Envelope protein E.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	112	1688	528	853	137	164	6	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	287	MET	LEU	engineered mutation	UNP Q6J3P1

4 Residue-property plots

4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-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. Stretches of 2 or more consecutive residues without any outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

• Molecule 1: Envelope protein E

Chain A:

4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

• Molecule 1: Envelope protein E

Chain A:

4.2.2 Score per residue for model 2

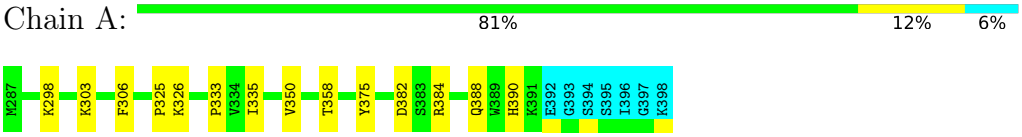
• Molecule 1: Envelope protein E

Chain A:

4.2.3 Score per residue for model 3 (medoid)

• Molecule 1: Envelope protein E

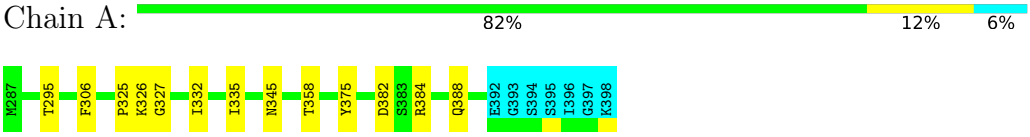
Chain A:



4.2.4 Score per residue for model 4

• Molecule 1: Envelope protein E

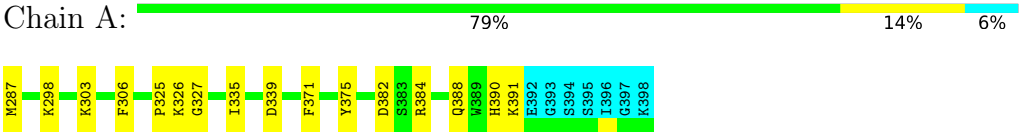
Chain A:



4.2.5 Score per residue for model 5

• Molecule 1: Envelope protein E

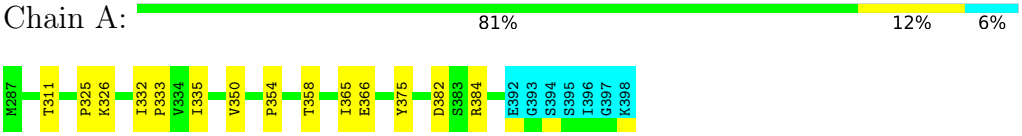
Chain A:



4.2.6 Score per residue for model 6

• Molecule 1: Envelope protein E

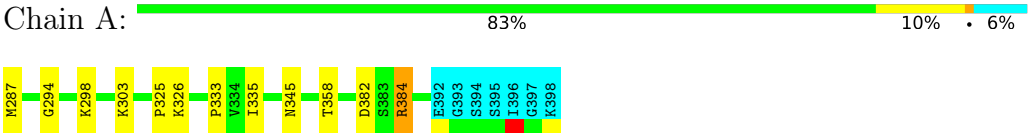
Chain A:



4.2.7 Score per residue for model 7

• Molecule 1: Envelope protein E

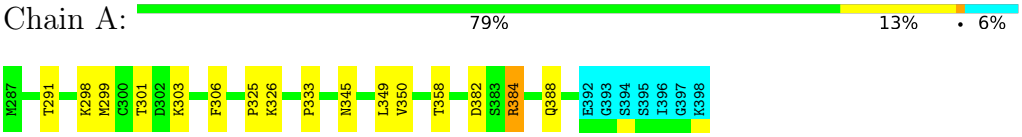
Chain A:



4.2.8 Score per residue for model 8

• Molecule 1: Envelope protein E

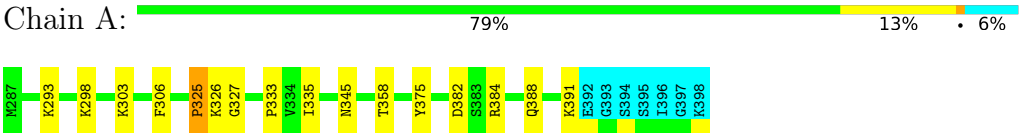
Chain A:



4.2.9 Score per residue for model 9

• Molecule 1: Envelope protein E

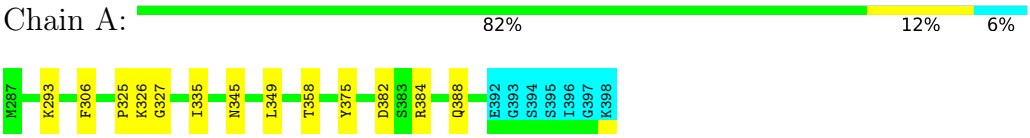
Chain A:



4.2.10 Score per residue for model 10

• Molecule 1: Envelope protein E

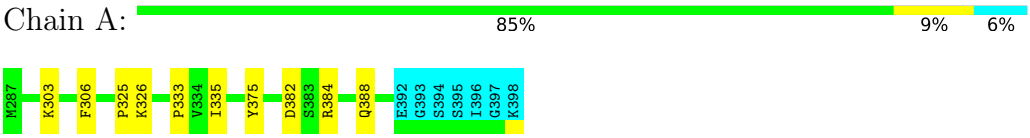
Chain A:



4.2.11 Score per residue for model 11

• Molecule 1: Envelope protein E

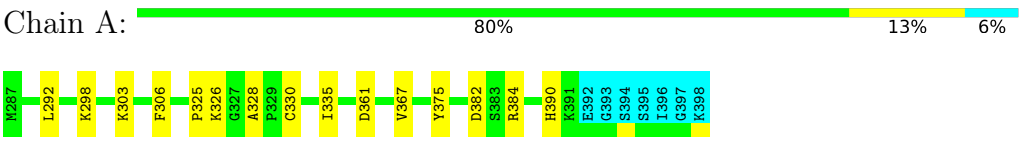
Chain A:



4.2.12 Score per residue for model 12

• Molecule 1: Envelope protein E

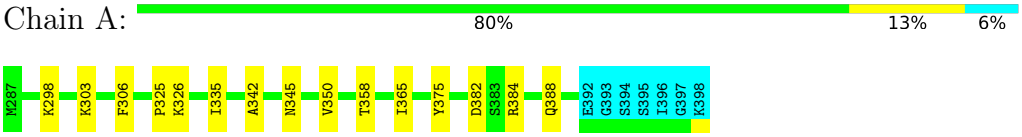
Chain A:



4.2.13 Score per residue for model 13

• Molecule 1: Envelope protein E

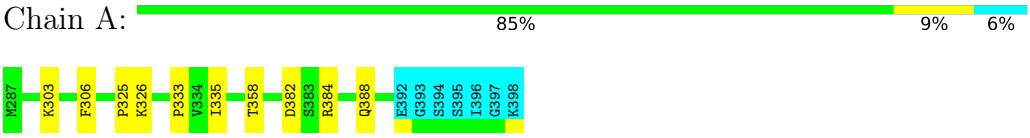
Chain A:



4.2.14 Score per residue for model 14

• Molecule 1: Envelope protein E

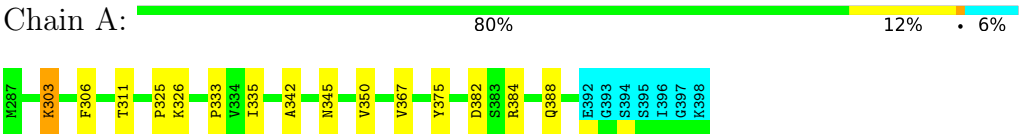
Chain A:



4.2.15 Score per residue for model 15

• Molecule 1: Envelope protein E

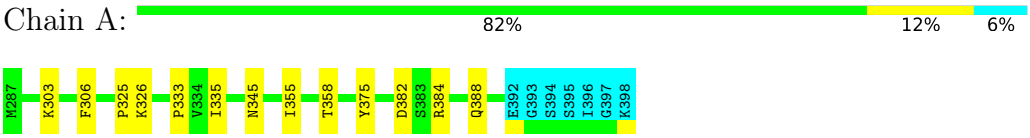
Chain A:



4.2.16 Score per residue for model 16

• Molecule 1: Envelope protein E

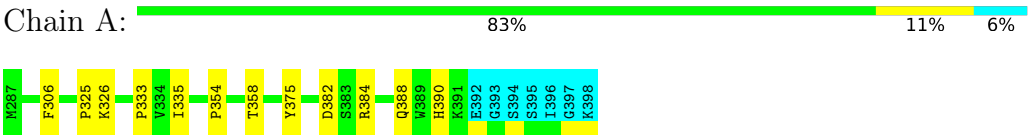
Chain A:



4.2.17 Score per residue for model 17

• Molecule 1: Envelope protein E

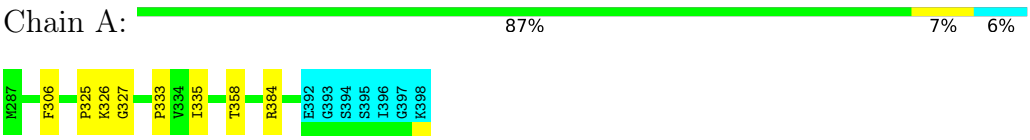
Chain A:



4.2.18 Score per residue for model 18

• Molecule 1: Envelope protein E

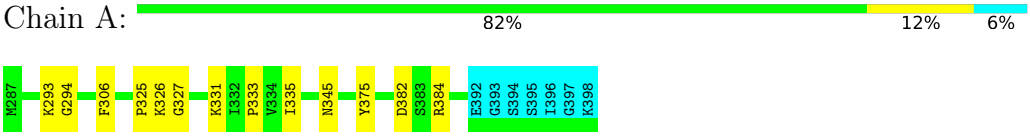
Chain A:



4.2.19 Score per residue for model 19

• Molecule 1: Envelope protein E

Chain A:



5 Refinement protocol and experimental data overview

The models were refined using the following method: *molecular dynamics*.

Of the 100 calculated structures, 19 were deposited, based on the following criterion: *structures with the least restraint violations*.

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
Amber	structure solution	6
Amber	refinement	6

No chemical shift data was provided.

6 Model quality

6.1 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 (average) 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	0.62±0.01	0±0/804 (0.0± 0.0%)	1.02±0.02	1±0/1097 (0.1± 0.0%)
All	All	0.62	0/15276 (0.0%)	1.02	20/20843 (0.1%)

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	Planarity
1	A	0.0±0.0	0.9±0.4
All	All	0	18

There are no bond-length outliers.

All unique angle outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})	Models	
								Worst	Total
1	A	384	ARG	NE-CZ-NH1	7.45	124.03	120.30	18	19
1	A	384	ARG	NE-CZ-NH2	-5.14	117.73	120.30	13	1

There are no chirality outliers.

All unique planar outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Group	Models (Total)
1	A	375	TYR	Sidechain	15
1	A	384	ARG	Sidechain	2
1	A	328	ALA	Peptide	1

6.2 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 each 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 averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	788	807	804	0±0
All	All	14972	15333	15276	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 0.

All unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:292:LEU:H	1:A:292:LEU:HD22	0.41	1.76	12	1

6.3 Torsion angles

6.3.1 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 PDB entries followed by that with respect to all NMR entries. 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	104/112 (93%)	94±1 (90±1%)	8±2 (8±2%)	2±1 (2±1%)	9	46
All	All	1976/2128 (93%)	1780 (90%)	149 (8%)	47 (2%)	9	46

All 9 unique Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	325	PRO	19
1	A	333	PRO	13
1	A	327	GLY	6
1	A	354	PRO	2
1	A	294	GLY	2
1	A	342	ALA	2
1	A	295	THR	1

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Mol	Chain	Res	Type	Models (Total)
1	A	291	THR	1
1	A	303	LYS	1

6.3.2 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 PDB entries followed by that with respect to all NMR entries. 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	91/96 (95%)	82±2 (90±2%)	9±2 (10±2%)	12	57
All	All	1729/1824 (95%)	1561 (90%)	168 (10%)	12	57

All 31 unique residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	326	LYS	19
1	A	335	ILE	18
1	A	382	ASP	18
1	A	306	PHE	17
1	A	358	THR	12
1	A	388	GLN	12
1	A	303	LYS	11
1	A	345	ASN	10
1	A	298	LYS	8
1	A	350	VAL	6
1	A	390	HIS	5
1	A	311	THR	3
1	A	293	LYS	3
1	A	299	MET	2
1	A	366	GLU	2
1	A	332	ILE	2
1	A	287	MET	2
1	A	391	LYS	2
1	A	365	ILE	2
1	A	349	LEU	2
1	A	367	VAL	2
1	A	364	LEU	1
1	A	359	ASN	1

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Mol	Chain	Res	Type	Models (Total)
1	A	339	ASP	1
1	A	371	PHE	1
1	A	301	THR	1
1	A	325	PRO	1
1	A	330	CYS	1
1	A	361	ASP	1
1	A	355	ILE	1
1	A	331	LYS	1

6.3.3 RNA

There are no RNA molecules in this entry.

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

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

6.5 Carbohydrates

There are no monosaccharides in this entry.

6.6 Ligand geometry

There are no ligands in this entry.

6.7 Other polymers

There are no such molecules in this entry.

6.8 Polymer linkage issues

There are no chain breaks in this entry.

7 Chemical shift validation

No chemical shift data were provided