Full wwPDB NMR Structure Validation Report (i)

Apr 26, 2016 – 02:05 PM BST

PDB ID	:	1CE4
Title	:	CONFORMATIONAL MODEL FOR THE CONSENSUS V3 LOOP OF THE ENVELOPE PROTEIN GP120 OF HIV-1
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Deposited on	:	1999-03-15

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
http://wwpdb.org/validation/2016/NMRValidationReportHelp
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:

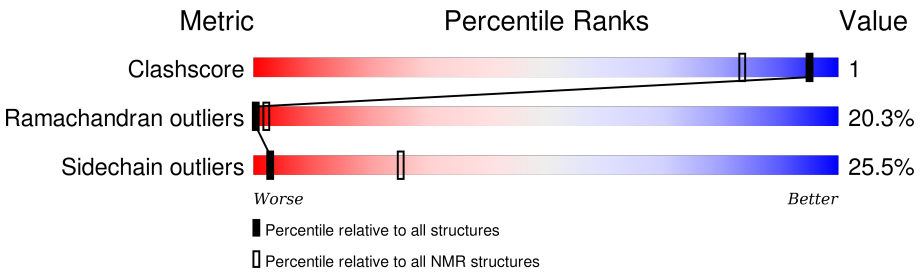
Cyrange	:	Kirchner and Güntert (2011)
NmrClust	:	Kelley et al. (1996)
MolProbity	:	4.02b-467
Mogul	:	unknown
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	rb-20027457
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20027457

1 Overall quality at a glance (i)

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	114402	11133
Ramachandran outliers	111179	9975
Sidechain outliers	111093	9958

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	35	54% 40% 6%

2 Ensemble composition and analysis (i)

This entry contains 20 models. Model 16 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative.

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:1-A:35 (35)	1.89	16

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 3 clusters. No single-model clusters were found.

Cluster number	Models
1	4, 5, 9, 10, 11, 12, 13, 17, 18, 19
2	2, 6, 7, 8, 14, 15, 16
3	1, 3, 20

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 543 atoms, of which 270 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN).

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	35	543	165	270	56	50	2	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	5	ASN	SER	SUBSTITION	UNP P20871

4 Residue-property plots (i)

4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA and DNA 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: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

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

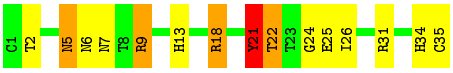
• Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A:

4.2.2 Score per residue for model 2

• Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A:



4.2.3 Score per residue for model 3

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A: 57% 23% 17% •

C1 T2 R3 P4 N5 N6 N7 T8 R9 K10 H13 I14 R18 A19 F20 Y21 T22 E25 I26 D29 C35

4.2.4 Score per residue for model 4

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A: 66% 20% 11% •

C1 P4 N5 N6 R9 K10 R18 A19 F20 Y21 E25 I26 C35

4.2.5 Score per residue for model 5

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A: 60% 29% 6% 6%

C1 T2 R3 P4 N5 N6 N7 H13 I14 F20 Y21 T22 E25 I26 C35

4.2.6 Score per residue for model 6

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A: 69% 17% 6% 9%

C1 T2 R3 N7 T8 R9 I14 G15 R18 Y21 E25 Q32 C35

4.2.7 Score per residue for model 7

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A: 54% 34% 11%

C1 T2 N5 N6 N7 T8 R9 K10 H13 R18 Y21 T22 E25 I26 D29 I30 R31 C35

4.2.8 Score per residue for model 8

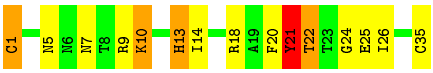
- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A: 63% 31% 6%

4.2.9 Score per residue for model 9

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

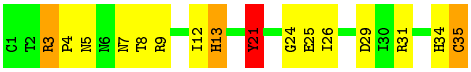
Chain A: 57% 29% 11% •



4.2.10 Score per residue for model 10

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A: 54% 34% 9% •



4.2.11 Score per residue for model 11

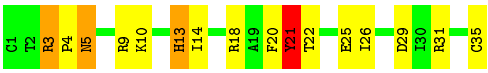
- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A: 66% 26% 9%

4.2.12 Score per residue for model 12

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

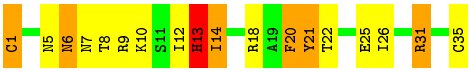
Chain A: 54% 34% 9% •



4.2.13 Score per residue for model 13

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

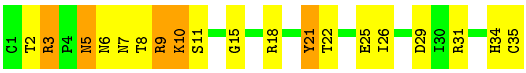
Chain A: 49% 31% 17% •



4.2.14 Score per residue for model 14

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A: 46% 40% 14%



4.2.15 Score per residue for model 15

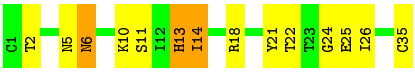
- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A: 51% 37% 11%

4.2.16 Score per residue for model 16 (medoid)

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

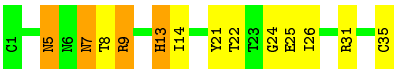
Chain A: 60% 31% 9%



4.2.17 Score per residue for model 17

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A: 63% 26% 11%



4.2.18 Score per residue for model 18

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A:

4.2.19 Score per residue for model 19

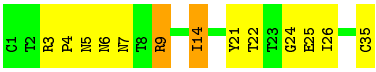
- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A:

4.2.20 Score per residue for model 20

- Molecule 1: PROTEIN (V3 LOOP OF HIV-1 ENVELOPE PROTEIN)

Chain A:



5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *DISTANCE GEOMETRY*.

Of the 500 calculated structures, 20 were deposited, based on the following criterion: *LOWEST TARGET FUNCTION*.

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

Software name	Classification	Version
DISCOVER	refinement	
UXNMR	structure solution	
PRONTO	structure solution	
DIANA	structure solution	

No chemical shift data was provided. No validations of the models with respect to experimental NMR restraints is performed at this time.

6 Model quality (i)

6.1 Standard geometry (i)

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	1.04±0.01	2±0/278 (0.7±0.0%)	1.39±0.09	2±2/373 (0.5±0.6%)
All	All	1.04	40/5560 (0.7%)	1.39	39/7460 (0.5%)

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	Planarity
1	A	0.0±0.0	1.5±1.2
All	All	0	30

All unique bond 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(Å)	Ideal(Å)	Models	
								Worst	Total
1	A	25	GLU	CD-OE2	9.52	1.36	1.25	3	20
1	A	35	CYS	C-OXT	7.07	1.36	1.23	9	20

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	21	TYR	CB-CG-CD2	-8.39	115.97	121.00	8	3
1	A	9	ARG	CD-NE-CZ	7.98	134.78	123.60	7	3
1	A	18	ARG	NE-CZ-NH2	-7.88	116.36	120.30	6	4
1	A	9	ARG	NE-CZ-NH1	7.65	124.12	120.30	3	4
1	A	18	ARG	NE-CZ-NH1	7.52	124.06	120.30	12	3
1	A	21	TYR	CB-CG-CD1	-7.11	116.73	121.00	19	2
1	A	18	ARG	CD-NE-CZ	6.79	133.10	123.60	6	2
1	A	9	ARG	NE-CZ-NH2	-6.68	116.96	120.30	13	4

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})	Models	
								Worst	Total
1	A	1	CYS	CA-CB-SG	6.53	125.76	114.00	19	4
1	A	3	ARG	NE-CZ-NH2	-6.36	117.12	120.30	6	1
1	A	21	TYR	CB-CA-C	6.21	122.82	110.40	4	1
1	A	9	ARG	N-CA-CB	-6.05	99.70	110.60	17	1
1	A	3	ARG	NE-CZ-NH1	5.72	123.16	120.30	6	1
1	A	31	ARG	NE-CZ-NH2	-5.59	117.51	120.30	13	1
1	A	13	HIS	CA-CB-CG	5.58	123.08	113.60	1	1
1	A	3	ARG	CD-NE-CZ	5.24	130.93	123.60	6	1
1	A	1	CYS	C-N-CA	5.18	134.65	121.70	5	1
1	A	31	ARG	CD-NE-CZ	5.17	130.84	123.60	7	1
1	A	20	PHE	C-N-CA	5.13	134.54	121.70	3	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	21	TYR	Sidechain	13
1	A	3	ARG	Sidechain	7
1	A	20	PHE	Sidechain	5
1	A	9	ARG	Sidechain	3
1	A	18	ARG	Sidechain	2

6.2 Too-close contacts (i)

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	273	270	267	1±1
All	All	5460	5400	5340	15

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 1.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:2:THR:HG22	1:A:3:ARG:N	0.71	1.99	15	1
1:A:14:ILE:HG22	1:A:15:GLY:H	0.65	1.52	1	1
1:A:21:TYR:O	1:A:22:THR:HG23	0.58	1.98	2	1
1:A:2:THR:CG2	1:A:3:ARG:N	0.53	2.70	15	1
1:A:14:ILE:HG22	1:A:15:GLY:N	0.52	2.17	1	1
1:A:13:HIS:CG	1:A:14:ILE:H	0.50	2.24	16	2
1:A:14:ILE:HD11	1:A:21:TYR:CD1	0.49	2.43	6	1
1:A:18:ARG:CD	1:A:18:ARG:H	0.48	2.22	1	1
1:A:31:ARG:NH1	1:A:34:HIS:NE2	0.44	2.64	2	3
1:A:2:THR:HG22	1:A:3:ARG:H	0.43	1.73	15	1
1:A:5:ASN:N	1:A:5:ASN:HD22	0.41	2.13	18	1
1:A:13:HIS:O	1:A:18:ARG:NH1	0.40	2.54	13	1

6.3 Torsion angles (i)

6.3.1 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 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	33/35 (94%)	17±2 (51±6%)	10±2 (29±6%)	7±2 (20±5%)	0 2
All	All	660/700 (94%)	334 (51%)	192 (29%)	134 (20%)	0 2

All 18 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	22	THR	16
1	A	14	ILE	14
1	A	5	ASN	13
1	A	13	HIS	12
1	A	21	TYR	12
1	A	4	PRO	10
1	A	6	ASN	9
1	A	2	THR	8
1	A	24	GLY	7
1	A	7	ASN	6
1	A	9	ARG	5

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Mol	Chain	Res	Type	Models (Total)
1	A	10	LYS	5
1	A	8	THR	5
1	A	11	SER	4
1	A	15	GLY	3
1	A	3	ARG	3
1	A	12	ILE	1
1	A	20	PHE	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	29/29 (100%)	22±2 (74±6%)	7±2 (26±6%)	3 25
All	All	580/580 (100%)	432 (74%)	148 (26%)	3 25

All 21 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	26	ILE	19
1	A	5	ASN	14
1	A	13	HIS	14
1	A	21	TYR	12
1	A	9	ARG	11
1	A	7	ASN	10
1	A	29	ASP	10
1	A	10	LYS	10
1	A	18	ARG	8
1	A	31	ARG	6
1	A	3	ARG	6
1	A	6	ASN	5
1	A	20	PHE	4
1	A	14	ILE	4
1	A	1	CYS	3
1	A	8	THR	3
1	A	12	ILE	3
1	A	22	THR	3

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Mol	Chain	Res	Type	Models (Total)
1	A	35	CYS	1
1	A	25	GLU	1
1	A	32	GLN	1

6.3.3 RNA (i)

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains (i)

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

6.5 Carbohydrates (i)

There are no carbohydrates in this entry.

6.6 Ligand geometry (i)

There are no ligands in this entry.

6.7 Other polymers (i)

There are no such molecules in this entry.

6.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

7 Chemical shift validation (i)

No chemical shift data were provided