



# Full wwPDB NMR Structure Validation Report ⓘ

Dec 13, 2023 – 10:29 PM EST

PDB ID : 2JO7  
Title : Solution structure of the adhesion protein Bd37 from Babesia divergens  
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Deposited on : 2007-02-26

This is a Full wwPDB NMR Structure 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

<https://www.wwpdb.org/validation/2017/NMRValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) 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

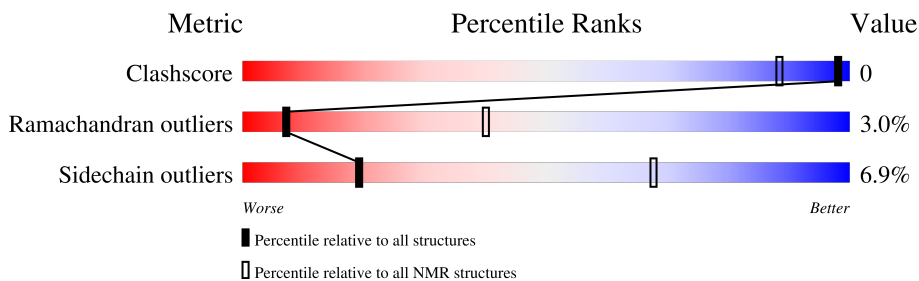
# 1 Overall quality at a glance

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  $\geq 3$ , 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  $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	224	 76% 6% • 17%

## 2 Ensemble composition and analysis i

This entry contains 10 models. Model 9 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *closest to the average*.

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:81-A:160, A:177-A:241, A:246-A:260, A:264-A:288 (185)	0.83	9

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 1 single-model cluster was found.

Cluster number	Models
1	2, 4, 5, 9, 10
2	1, 3, 6, 7
Single-model clusters	8

### 3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 3526 atoms, of which 1792 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Glycosylphosphatidylinositol-anchored merozoite surface protein.

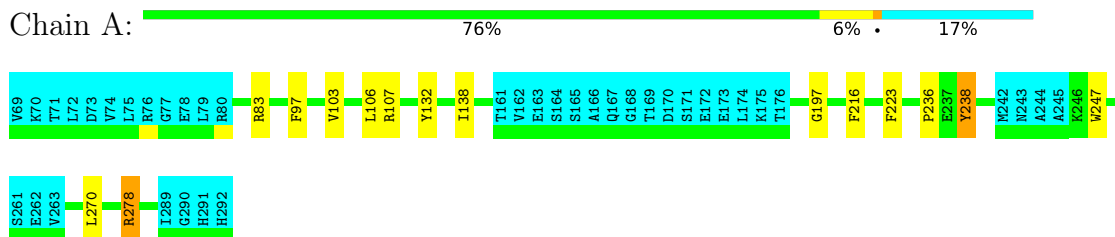
Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	224	3526	1103	1792	284	341	6	0

## 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: Glycosylphosphatidylinositol-anchored merozoite surface protein

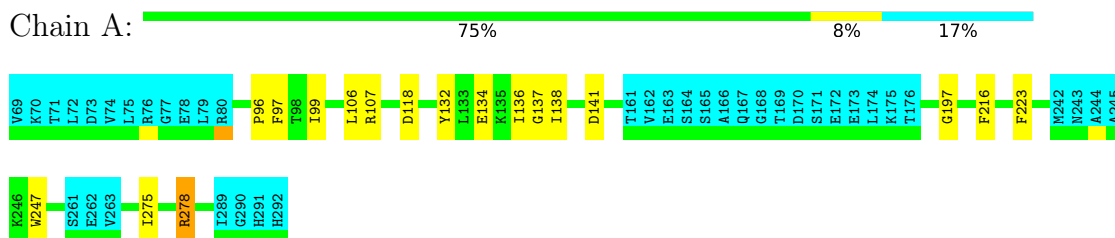


### 4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

#### 4.2.1 Score per residue for model 1

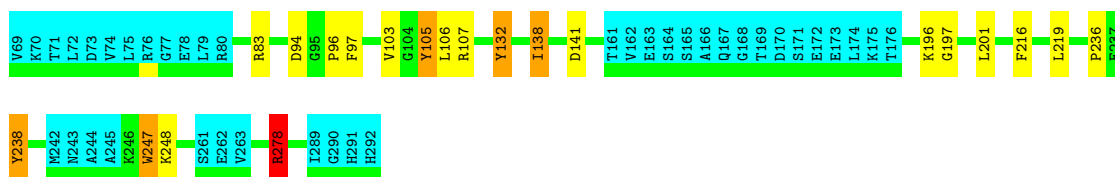
- Molecule 1: Glycosylphosphatidylinositol-anchored merozoite surface protein



#### 4.2.2 Score per residue for model 2

- Molecule 1: Glycosylphosphatidylinositol-anchored merozoite surface protein

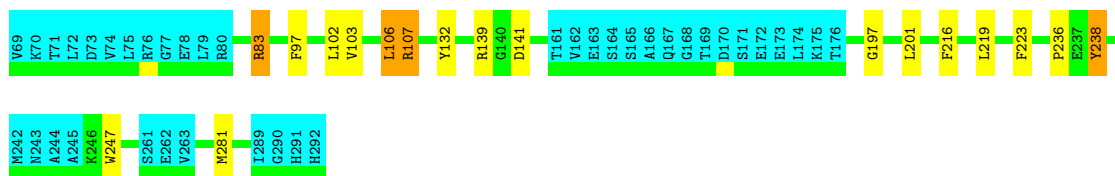




#### 4.2.3 Score per residue for model 3

- Molecule 1: Glycosylphosphatidylinositol-anchored merozoite surface protein

Chain A: 75% 6% 17%



#### 4.2.4 Score per residue for model 4

- Molecule 1: Glycosylphosphatidylinositol-anchored merozoite surface protein

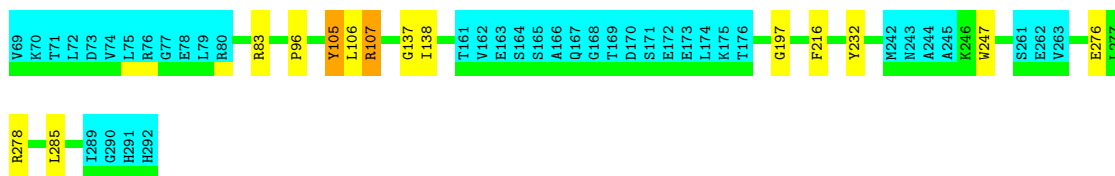
Chain A: 75% 6% 17%



#### 4.2.5 Score per residue for model 5

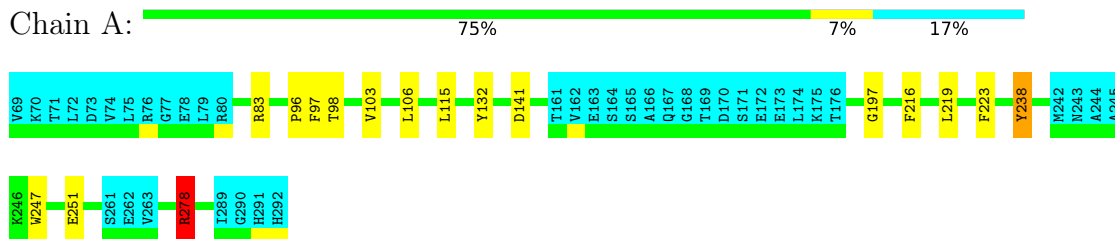
- Molecule 1: Glycosylphosphatidylinositol-anchored merozoite surface protein

Chain A: 76% 5% 17%



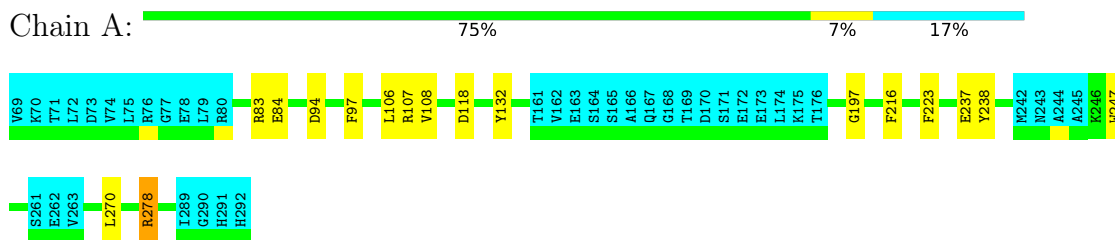
#### 4.2.6 Score per residue for model 6

- Molecule 1: Glycosylphosphatidylinositol-anchored merozoite surface protein



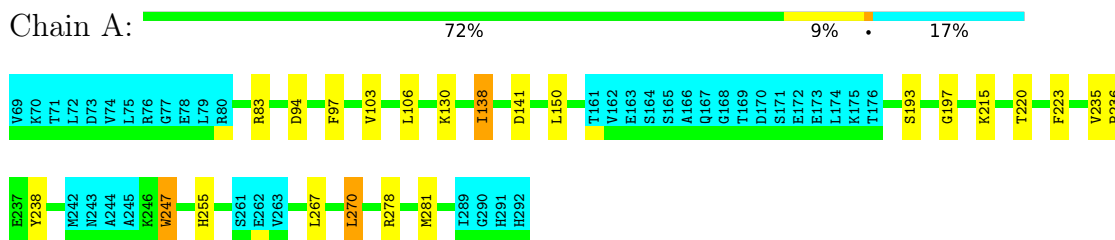
#### 4.2.7 Score per residue for model 7

- Molecule 1: Glycosylphosphatidylinositol-anchored merozoite surface protein



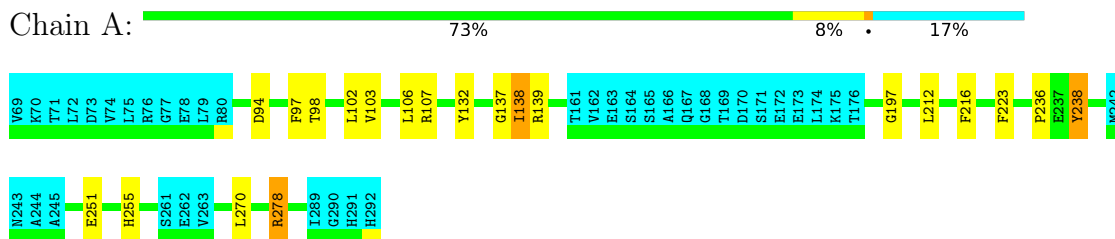
#### 4.2.8 Score per residue for model 8

- Molecule 1: Glycosylphosphatidylinositol-anchored merozoite surface protein



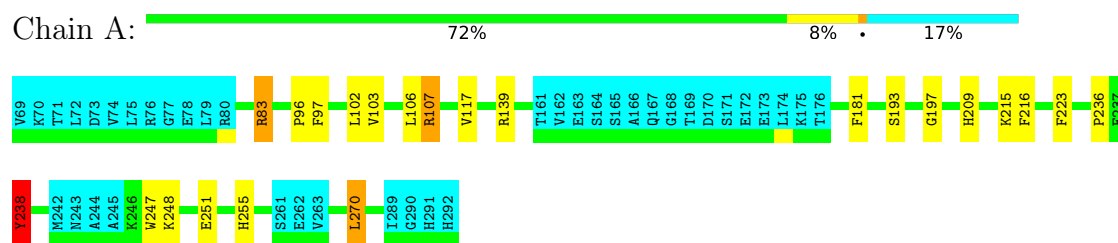
#### 4.2.9 Score per residue for model 9 (medoid)

- Molecule 1: Glycosylphosphatidylinositol-anchored merozoite surface protein



#### 4.2.10 Score per residue for model 10

- Molecule 1: Glycosylphosphatidylinositol-anchored merozoite surface protein





## 5 Refinement protocol and experimental data overview

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

Of the 100 calculated structures, 10 were deposited, based on the following criterion: *structures with the lowest energy*.

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

Software name	Classification	Version
PREDITOR	geometry optimization	1
CYANA	structure solution	
Amber	refinement	8
TALOS	geometry optimization	

No chemical shift data was provided.

## 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	0.68±0.01	0±0/1463 ( 0.0± 0.0%)	1.00±0.01	2±1/1969 ( 0.1± 0.1%)
All	All	0.68	0/14630 ( 0.0%)	1.00	23/19690 ( 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	1.9±1.0
All	All	0	19

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(°)	Ideal(°)	Models	
								Worst	Total
1	A	83	ARG	NE-CZ-NH1	9.75	125.17	120.30	7	7
1	A	278	ARG	NE-CZ-NH1	7.98	124.29	120.30	9	4
1	A	107	ARG	NE-CZ-NH1	7.81	124.20	120.30	4	7
1	A	139	ARG	NE-CZ-NH1	5.62	123.11	120.30	3	3
1	A	181	PHE	CB-CG-CD2	-5.47	116.97	120.80	10	1
1	A	106	LEU	CB-CA-C	5.01	119.72	110.20	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	132	TYR	Sidechain	5
1	A	278	ARG	Sidechain	4

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Mol	Chain	Res	Type	Group	Models (Total)
1	A	238	TYR	Sidechain	4
1	A	105	TYR	Sidechain	3
1	A	107	ARG	Sidechain	2
1	A	232	TYR	Sidechain	1

## 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	1441	1500	1497	1±1
All	All	14410	15000	14970	9

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:215:LYS:HB3	1:A:270:LEU:HD11	0.46	1.86	8	1
1:A:103:VAL:HG22	1:A:238:TYR:CE2	0.43	2.48	10	4
1:A:215:LYS:CB	1:A:270:LEU:HD11	0.42	2.44	8	2
1:A:247:TRP:CZ3	1:A:278:ARG:HD3	0.42	2.50	2	1
1:A:235:VAL:HG22	1:A:247:TRP:CD2	0.41	2.51	8	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	185/224 (83%)	167±3 (90±1%)	12±2 (7±1%)	6±1 (3±1%)	7	40
All	All	1850/2240 (83%)	1674 (90%)	121 (7%)	55 (3%)	7	40

All 10 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	197	GLY	10
1	A	97	PHE	9
1	A	238	TYR	7
1	A	236	PRO	6
1	A	96	PRO	5
1	A	138	ILE	5
1	A	141	ASP	5
1	A	94	ASP	4
1	A	137	GLY	3
1	A	237	GLU	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	157/190 (83%)	146±2 (93±1%)	11±2 (7±1%)	19	68
All	All	1570/1900 (83%)	1462 (93%)	108 (7%)	19	68

All 43 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	106	LEU	10
1	A	216	PHE	9
1	A	247	TRP	9
1	A	223	PHE	7
1	A	278	ARG	7
1	A	270	LEU	5
1	A	132	TYR	3
1	A	138	ILE	3
1	A	219	LEU	3
1	A	83	ARG	3
1	A	102	LEU	3
1	A	107	ARG	3
1	A	251	GLU	3
1	A	255	HIS	3

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Mol	Chain	Res	Type	Models (Total)
1	A	118	ASP	2
1	A	105	TYR	2
1	A	201	LEU	2
1	A	248	LYS	2
1	A	103	VAL	2
1	A	281	MET	2
1	A	98	THR	2
1	A	193	SER	2
1	A	99	ILE	1
1	A	134	GLU	1
1	A	136	ILE	1
1	A	275	ILE	1
1	A	196	LYS	1
1	A	101	GLN	1
1	A	113	LEU	1
1	A	139	ARG	1
1	A	233	LEU	1
1	A	276	GLU	1
1	A	285	LEU	1
1	A	115	LEU	1
1	A	84	GLU	1
1	A	108	VAL	1
1	A	130	LYS	1
1	A	150	LEU	1
1	A	220	THR	1
1	A	267	LEU	1
1	A	212	LEU	1
1	A	117	VAL	1
1	A	209	HIS	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 monosaccharides 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

No chemical shift data were provided