



# Full wwPDB NMR Structure Validation Report ⓘ

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PDB ID : 2KHU  
Title : Solution Structure of the Ubiquitin-Binding Motif of Human Polymerase Iota  
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Deposited on : 2009-04-11

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.

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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  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
RCI : v\_1n\_11\_5\_13\_A (Berjanski et al., 2005)  
PANAV : Wang et al. (2010)  
ShiftChecker : 2.27  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.27

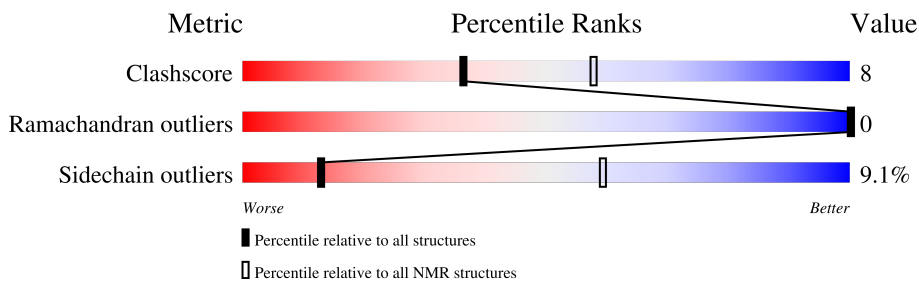
# 1 Overall quality at a glance

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	108	 22%    • 5%    70%

## 2 Ensemble composition and analysis

This entry contains 25 models. Model 21 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *lowest energy*.

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:63-A:89 (27)	0.09	21

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 4 clusters and 1 single-model cluster was found.

Cluster number	Models
1	1, 3, 4, 10, 11, 15, 20, 21, 24, 25
2	2, 5, 6, 7, 9, 12, 13, 19, 23
3	8, 14, 18
4	16, 17
Single-model clusters	22

### 3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 528 atoms, of which 263 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Immunoglobulin G-binding protein G, DNA polymerase iota.

Mol	Chain	Residues	Atoms					Trace
			Total	C	H	N	O	
1	A	32	528	174	263	41	50	0

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	SEE REMARK 999	UNP P19909
A	2	GLN	-	SEE REMARK 999	UNP P19909
A	57	GLY	-	SEE REMARK 999	UNP Q9UNA4
A	58	SER	-	SEE REMARK 999	UNP Q9UNA4
A	59	ASP	-	SEE REMARK 999	UNP Q9UNA4
A	60	GLU	-	SEE REMARK 999	UNP Q9UNA4
A	101	LEU	-	expression tag	UNP Q9UNA4
A	102	GLU	-	expression tag	UNP Q9UNA4
A	103	HIS	-	expression tag	UNP Q9UNA4
A	104	HIS	-	expression tag	UNP Q9UNA4
A	105	HIS	-	expression tag	UNP Q9UNA4
A	106	HIS	-	expression tag	UNP Q9UNA4
A	107	HIS	-	expression tag	UNP Q9UNA4
A	108	HIS	-	expression tag	UNP Q9UNA4

## 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: Immunoglobulin G-binding protein G, DNA polymerase iota

Chain A: 

MET GLN TYR LYS LEU ILE LEU ASN GLY THR THR THR GLU ALA VAL ASP ALA ALA ALA ALA ALA GLU LYS VAL PHE LYS GLN TYR ALA ASN ASP ASN GLY VAL ASP GLY TRP THR TYR ASP ASP ALA THR LYS THR PHE THR VAL THR VAL THR GLY SER ASP GLU

K61 I62 F73 Q81 W88 K89 R90 T91 G92 SER ASP PHE HIS ILE GLY HIS LYS LEU GLU HIS HIS HIS HIS HIS HIS

### 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: Immunoglobulin G-binding protein G, DNA polymerase iota

Chain A: 

MET GLN TYR LYS LEU ILE LEU ASN GLY THR THR THR GLU ALA VAL ASP ALA ALA ALA ALA GLU LYS VAL PHE LYS GLN TYR ALA ASN ASP ASN GLY VAL ASP GLY TRP THR TYR ASP ASP ALA THR LYS THR PHE THR VAL THR VAL THR GLY SER ASP GLU

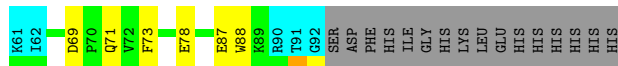
K61 I62 S66 F73 L84 W88 K89 R90 T91 G92 SER ASP PHE HIS ILE GLY HIS LYS LEU GLU HIS HIS HIS HIS HIS HIS

#### 4.2.2 Score per residue for model 2

- Molecule 1: Immunoglobulin G-binding protein G, DNA polymerase iota

Chain A: 

MET GLN TYR LYS LEU ILE LEU ASN GLY LYS THR LEU LYS GLY GLU THR THR GLU ALA VAL ASP ILE ALA ALA THR ALA GLU VAL PHE HIS LYS GLN TYR ALA ASN ASP ASN GLY VAL ASP GLY GLU TRP THR TYR ASP ASP ALA THR LYS THR PHE THR VAL THR GLU GLY SER ASP GLU

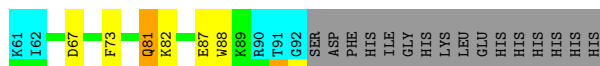


#### 4.2.3 Score per residue for model 3

- Molecule 1: Immunoglobulin G-binding protein G, DNA polymerase iota

Chain A: 19% 5% • 5% 70%

MET GLN TYR LYS LEU ILE LEU ASN GLY LYS THR LEU LYS GLY GLU THR THR GLU ALA VAL ASP ILE ALA ALA THR ALA GLU VAL PHE HIS LYS GLN TYR ALA ASN ASP ASN GLY VAL ASP GLY GLU TRP THR TYR ASP ASP ALA THR LYS THR PHE THR VAL THR GLU GLY SER ASP GLU



#### 4.2.4 Score per residue for model 4

- Molecule 1: Immunoglobulin G-binding protein G, DNA polymerase iota

Chain A: 21% • • 5% 70%

MET GLN TYR LYS LEU ILE LEU ASN GLY LYS THR LEU LYS GLY GLU THR THR GLU ALA VAL ASP ILE ALA ALA THR ALA GLU VAL PHE HIS LYS GLN TYR ALA ASN ASP ASN GLY VAL ASP GLY GLU TRP THR TYR ASP ASP ALA THR LYS THR PHE THR VAL THR GLU GLY SER ASP GLU



#### 4.2.5 Score per residue for model 5

- Molecule 1: Immunoglobulin G-binding protein G, DNA polymerase iota

Chain A: 20% • • 5% 70%

MET GLN TYR LYS LEU ILE LEU ASN GLY LYS THR LEU LYS GLY GLU THR THR GLU ALA VAL ASP ILE ALA ALA THR ALA GLU VAL PHE HIS LYS GLN TYR ALA ASN ASP ASN GLY VAL ASP GLY GLU TRP THR TYR ASP ASP ALA THR LYS THR PHE THR VAL THR GLU GLY SER ASP GLU



#### 4.2.6 Score per residue for model 6

- Molecule 1: Immunoglobulin G-binding protein G, DNA polymerase iota



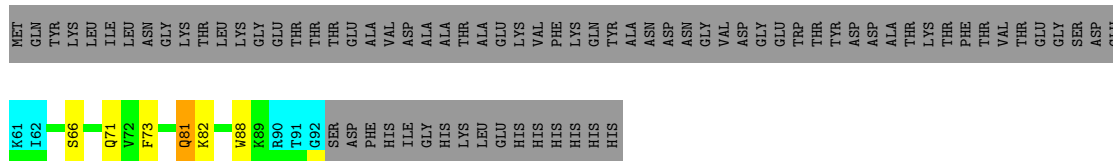




#### 4.2.14 Score per residue for model 14

- Molecule 1: Immunoglobulin G-binding protein G, DNA polymerase iota

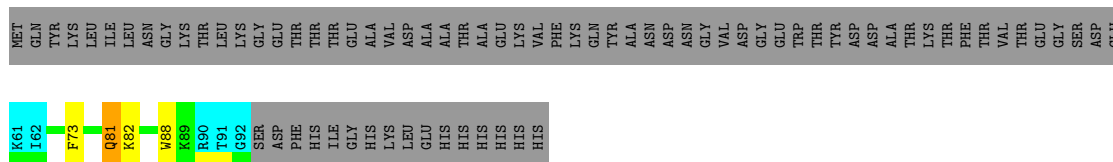
Chain A: 19% 5% • 5% 70%



#### 4.2.15 Score per residue for model 15

- Molecule 1: Immunoglobulin G-binding protein G, DNA polymerase iota

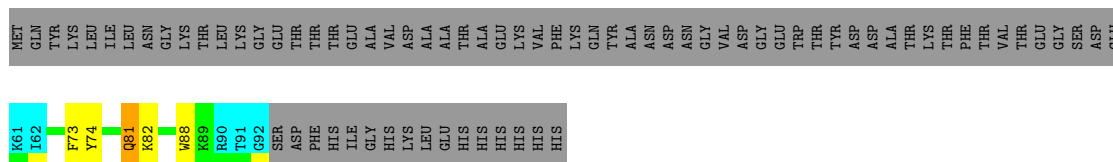
Chain A: 21% • • 5% 70%



#### 4.2.16 Score per residue for model 16

- Molecule 1: Immunoglobulin G-binding protein G, DNA polymerase iota

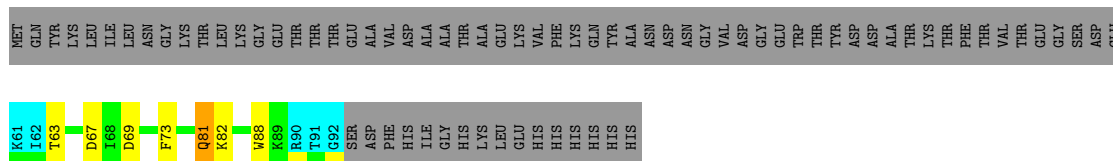
Chain A: 20% • • 5% 70%



#### 4.2.17 Score per residue for model 17

- Molecule 1: Immunoglobulin G-binding protein G, DNA polymerase iota

Chain A: 19% 6% • 5% 70%







## 5 Refinement protocol and experimental data overview

The models were refined using the following method: *simulated annealing*.

Of the 40 calculated structures, 25 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
X-PLOR NIH	structure solution	2.19
X-PLOR NIH	refinement	2.19

No chemical shift data was provided.

## 6 Model quality i

### 6.1 Standard geometry i

There are no covalent bond-length or bond-angle outliers.

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 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	226	216	216	4±2
All	All	5650	5400	5400	93

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 8.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:73:PHE:CZ	1:A:88:TRP:CH2	0.70	2.79	17	14
1:A:73:PHE:CD2	1:A:81:GLN:OE1	0.63	2.52	17	12
1:A:73:PHE:CE2	1:A:81:GLN:OE1	0.60	2.55	4	12
1:A:70:PRO:O	1:A:74:TYR:CD2	0.58	2.56	12	1
1:A:78:GLU:OE1	1:A:78:GLU:N	0.58	2.37	23	1
1:A:73:PHE:CE1	1:A:88:TRP:CH2	0.58	2.92	16	23
1:A:78:GLU:CD	1:A:78:GLU:N	0.53	2.60	7	4
1:A:78:GLU:N	1:A:78:GLU:OE2	0.53	2.42	18	1
1:A:67:ASP:N	1:A:67:ASP:OD1	0.52	2.43	22	1
1:A:75:GLU:O	1:A:75:GLU:OE1	0.49	2.31	11	1
1:A:73:PHE:CE1	1:A:88:TRP:CZ2	0.47	3.02	16	1
1:A:67:ASP:OD1	1:A:67:ASP:O	0.47	2.33	25	2
1:A:88:TRP:CD1	1:A:88:TRP:N	0.44	2.83	15	7
1:A:85:LEU:HD23	1:A:88:TRP:CE3	0.44	2.47	7	3

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:78:GLU:CG	1:A:79:ALA:N	0.44	2.80	21	1
1:A:84:LEU:O	1:A:88:TRP:CD1	0.44	2.70	1	2
1:A:69:ASP:C	1:A:69:ASP:OD1	0.44	2.56	17	1
1:A:66:SER:C	1:A:67:ASP:OD1	0.43	2.56	22	1
1:A:75:GLU:O	1:A:75:GLU:CD	0.43	2.57	11	1
1:A:78:GLU:CD	1:A:78:GLU:H	0.42	2.18	11	1
1:A:88:TRP:N	1:A:88:TRP:CD1	0.41	2.87	3	1
1:A:69:ASP:OD1	1:A:71:GLN:N	0.41	2.53	11	2

## 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	27/108 (25%)	25±0 (94±2%)	2±0 (6±2%)	0±0 (0±0%)	100	100
All	All	675/2700 (25%)	632 (94%)	43 (6%)	0 (0%)	100	100

There are no Ramachandran outliers.

### 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	25/93 (27%)	23±1 (91±5%)	2±1 (9±5%)	13	59
All	All	625/2325 (27%)	568 (91%)	57 (9%)	13	59

All 10 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	81	GLN	13
1	A	66	SER	10
1	A	67	ASP	9
1	A	63	THR	7
1	A	82	LYS	6
1	A	89	LYS	4
1	A	71	GLN	4
1	A	78	GLU	2
1	A	87	GLU	1
1	A	75	GLU	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