



# wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 17, 2023 – 10:01 PM EDT

PDB ID : 4YXK  
Title : Crystal structure of Elk prion protein complexed with POM1 FAB  
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Deposited on : 2015-03-23  
Resolution : 2.81 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](mailto: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 ⓘ 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:

MolProbity : 4.02b-467  
Xtriage (Phenix) : 1.13  
EDS : 2.35.1  
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) : 2.35.1

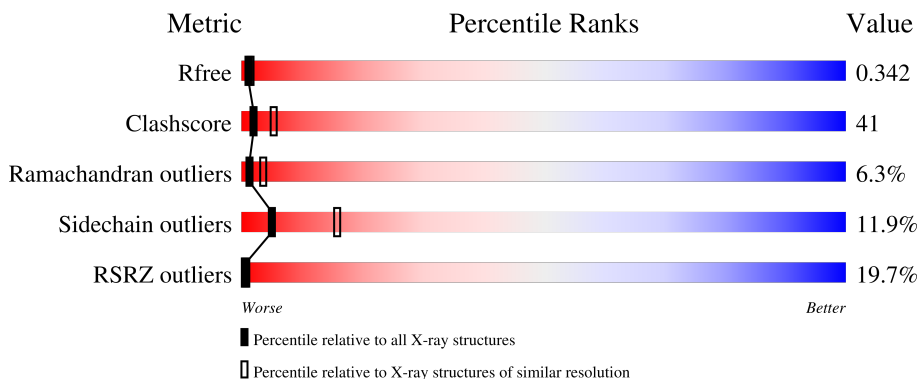
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.81 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	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)

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 of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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  $\leq 5\%$ . 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	135	
2	H	218	
3	L	213	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	NA	L	301	-	-	-	X

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 4208 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 Major prion protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	101	840	521	146	165	8	0	0	0

There are 27 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	93	MET	-	expression tag	UNP P67986
A	94	GLY	-	expression tag	UNP P67986
A	95	SER	-	expression tag	UNP P67986
A	96	SER	-	expression tag	UNP P67986
A	97	HIS	-	expression tag	UNP P67986
A	98	HIS	-	expression tag	UNP P67986
A	99	HIS	-	expression tag	UNP P67986
A	100	HIS	-	expression tag	UNP P67986
A	101	HIS	-	expression tag	UNP P67986
A	102	HIS	-	expression tag	UNP P67986
A	103	SER	-	expression tag	UNP P67986
A	104	SER	-	expression tag	UNP P67986
A	105	GLY	-	expression tag	UNP P67986
A	106	LEU	-	expression tag	UNP P67986
A	107	VAL	-	expression tag	UNP P67986
A	108	PRO	-	expression tag	UNP P67986
A	109	ARG	-	expression tag	UNP P67986
A	110	GLY	-	expression tag	UNP P67986
A	111	SER	-	expression tag	UNP P67986
A	112	HIS	-	expression tag	UNP P67986
A	113	MET	-	expression tag	UNP P67986
A	114	LEU	-	expression tag	UNP P67986
A	115	GLU	-	expression tag	UNP P67986
A	116	ASP	-	expression tag	UNP P67986
A	117	PRO	-	expression tag	UNP P67986
A	118	HIS	-	expression tag	UNP P67986
A	119	MET	-	expression tag	UNP P67986

- Molecule 2 is a protein called POM1 FAB HEAVY CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	H	218	1642	1037	265	330	10	0	0	0

- Molecule 3 is a protein called POM1 FAB LIGHT CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	L	213	1652	1022	280	345	5	0	0	0

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Na		
4	L	1	1	1	0	0

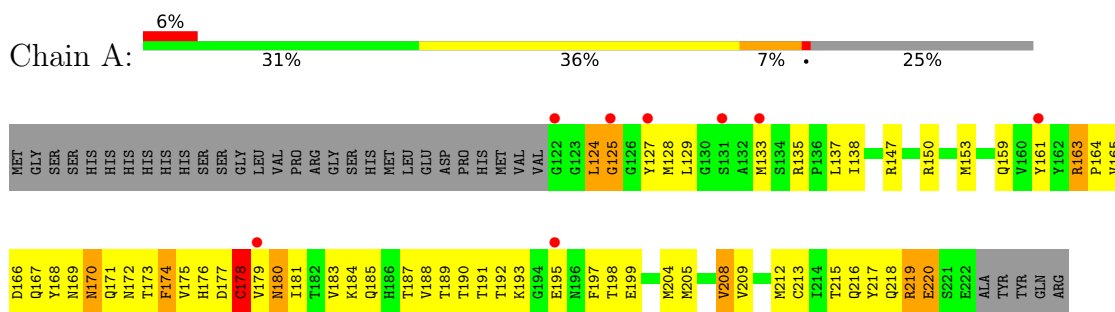
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	23	23	23	0	0
5	H	28	28	28	0	0
5	L	22	22	22	0	0

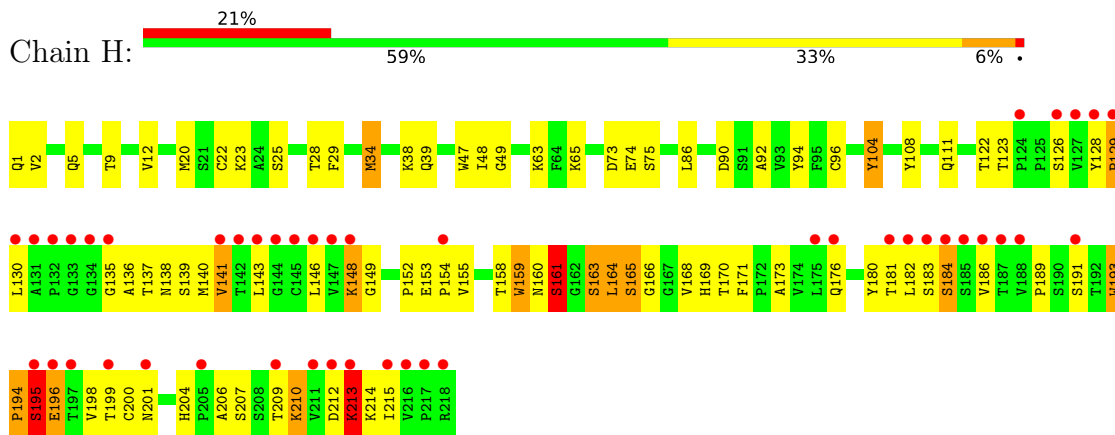
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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.

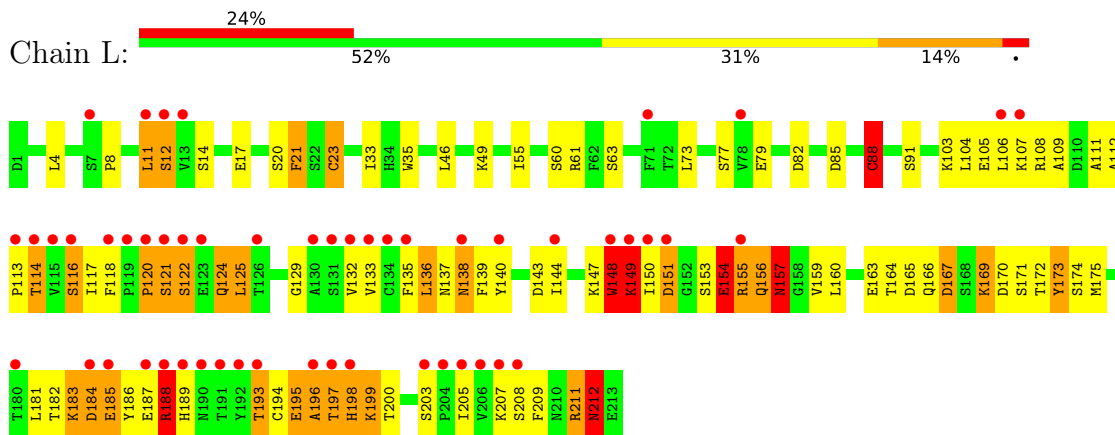
- Molecule 1: Major prion protein



- Molecule 2: POM1 FAB HEAVY CHAIN



- Molecule 3: POM1 FAB LIGHT CHAIN



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	84.67Å 105.51Å 76.11Å 90.00° 95.22° 90.00°	Depositor
Resolution (Å)	42.16 – 2.81 42.16 – 2.80	Depositor EDS
% Data completeness (in resolution range)	97.4 (42.16-2.81) 97.6 (42.16-2.80)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.11	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.70 (at 2.81Å)	Xtrriage
Refinement program	PHENIX 1.9_1692	Depositor
R, $R_{free}$	0.300 , 0.353 0.306 , 0.342	Depositor DCC
$R_{free}$ test set	809 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	58.7	Xtrriage
Anisotropy	0.808	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 59.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.86	EDS
Total number of atoms	4208	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	81.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.70% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: NA

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	0.86	0/858	0.98	1/1159 (0.1%)
2	H	0.84	1/1688 (0.1%)	1.06	2/2306 (0.1%)
3	L	0.65	0/1687	1.02	3/2291 (0.1%)
All	All	0.78	1/4233 (0.0%)	1.03	6/5756 (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 outliers	#Planarity outliers
3	L	0	4

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	H	104	TYR	CD1-CE1	-5.38	1.31	1.39

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	L	88	CYS	CA-CB-SG	6.68	126.03	114.00
2	H	213	LYS	N-CA-C	-6.39	93.74	111.00
2	H	210	LYS	N-CA-C	6.26	127.89	111.00
1	A	124	LEU	CA-CB-CG	5.91	128.89	115.30
3	L	4	LEU	CA-CB-CG	5.87	128.81	115.30

There are no chirality outliers.

All (4) planarity outliers are listed below:



Mol	Chain	Res	Type	Group
3	L	148	TRP	Peptide
3	L	149	LYS	Peptide
3	L	154	GLU	Peptide
3	L	188	ARG	Sidechain

## 5.2 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 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	840	0	784	68	0
2	H	1642	0	1580	112	0
3	L	1652	0	1577	156	0
4	L	1	0	0	0	0
5	A	23	0	0	5	0
5	H	28	0	0	2	1
5	L	22	0	0	0	0
All	All	4208	0	3941	327	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 41.

The worst 5 of 327 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)
3:L:198:HIS:CE1	3:L:199:LYS:HD2	1.48	1.47
3:L:198:HIS:ND1	3:L:199:LYS:CD	1.95	1.30
1:A:180:ASN:ND2	1:A:181:ILE:HD12	1.42	1.29
3:L:198:HIS:ND1	3:L:199:LYS:HD2	0.98	1.29
3:L:198:HIS:CE1	3:L:199:LYS:CD	2.16	1.26

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:H:303:HOH:O	5:H:311:HOH:O[2_555]	2.04	0.16

## 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	99/135 (73%)	90 (91%)	4 (4%)	5 (5%)	2	6
2	H	216/218 (99%)	193 (89%)	13 (6%)	10 (5%)	2	7
3	L	211/213 (99%)	174 (82%)	19 (9%)	18 (8%)	1	1
All	All	526/566 (93%)	457 (87%)	36 (7%)	33 (6%)	1	3

5 of 33 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	170	ASN
1	A	219	ARG
2	H	129	PRO
2	H	161	SER
2	H	165	SER

### 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	93/123 (76%)	84 (90%)	9 (10%)	8	24
2	H	187/187 (100%)	169 (90%)	18 (10%)	8	24
3	L	191/191 (100%)	162 (85%)	29 (15%)	3	8
All	All	471/501 (94%)	415 (88%)	56 (12%)	5	16

5 of 56 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	L	12	SER
3	L	212	ASN
3	L	117	ILE
3	L	211	ARG
3	L	184	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	139	HIS
1	A	180	ASN
2	H	160	ASN
3	L	198	HIS

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	101/135 (74%)	0.55	8 (7%) 12 7	29, 68, 108, 120	0
2	H	218/218 (100%)	1.09	45 (20%) 1 0	23, 49, 163, 187	0
3	L	213/213 (100%)	1.53	52 (24%) 0 0	31, 90, 159, 165	0
All	All	532/566 (93%)	1.16	105 (19%) 1 0	23, 73, 158, 187	0

The worst 5 of 105 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	L	206	VAL	28.4
2	H	141	VAL	17.8
3	L	133	VAL	12.2
3	L	121	SER	11.4
3	L	122	SER	11.1

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

### 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

### 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q < 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	NA	L	301	1/1	0.54	0.66	99,99,99,99	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.