



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 06:39 AM UTC

PDB ID : 4LLI / pdb\_00004lli  
Title : Crystal Structure of human Myosin 5a globular domain  
Authors : Velvarska, H.; Niessing, D.  
Deposited on : 2013-07-09  
Resolution : 2.20 Å(reported)

This is a Full wwPDB X-ray 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/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 : 4-5-2 with Phenix2.0  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

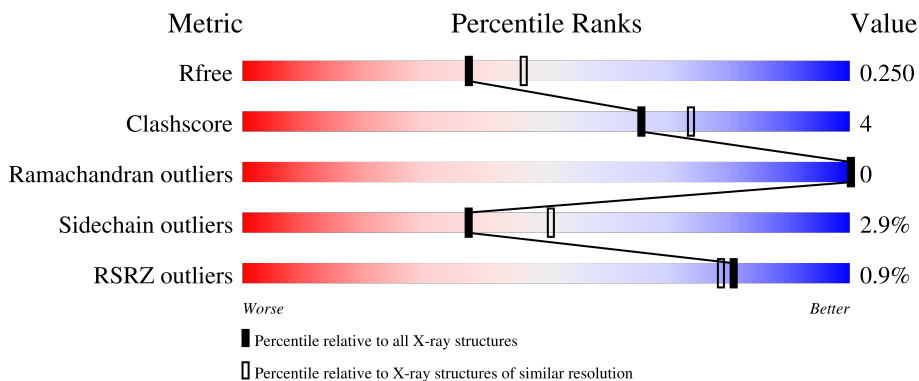
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.20 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))
$R_{free}$	180053	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	395	
1	B	395	

## 2 Entry composition i

There are 2 unique types of molecules in this entry. The entry contains 6441 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 Unconventional myosin-Va.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	377	3033	1928	522	560	23	0	1	0
1	B	377	3030	1926	522	559	23	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1461	GLY	-	expression tag	UNP Q9Y4I1
A	1462	PRO	-	expression tag	UNP Q9Y4I1
A	1463	LEU	-	expression tag	UNP Q9Y4I1
A	1464	GLY	-	expression tag	UNP Q9Y4I1
A	1465	SER	-	expression tag	UNP Q9Y4I1
A	1466	MET	-	expression tag	UNP Q9Y4I1
B	1461	GLY	-	expression tag	UNP Q9Y4I1
B	1462	PRO	-	expression tag	UNP Q9Y4I1
B	1463	LEU	-	expression tag	UNP Q9Y4I1
B	1464	GLY	-	expression tag	UNP Q9Y4I1
B	1465	SER	-	expression tag	UNP Q9Y4I1
B	1466	MET	-	expression tag	UNP Q9Y4I1

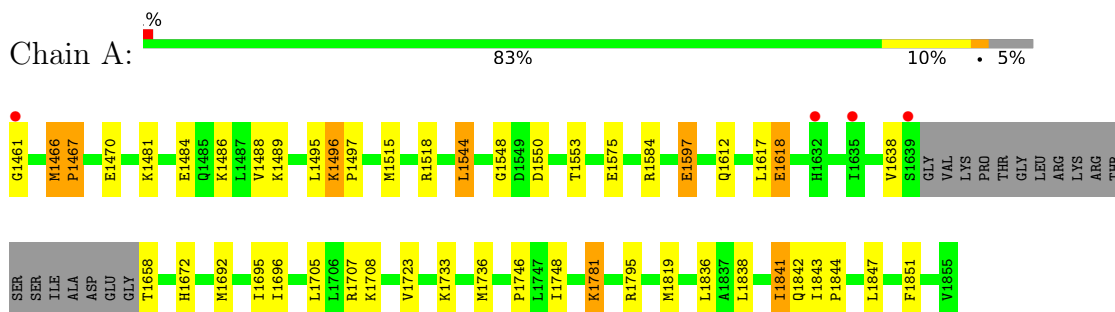
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	183	Total 183	O 183	0	0
2	B	195	Total 195	O 195	0	0

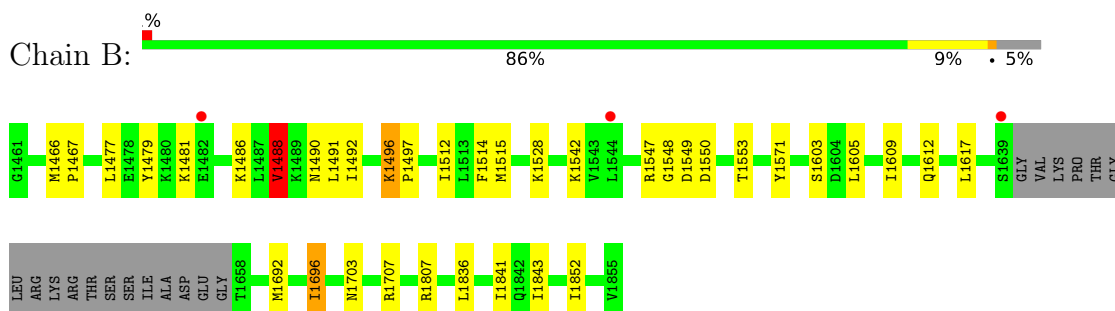
### 3 Residue-property plots [i](#)

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: Unconventional myosin-Va



- Molecule 1: Unconventional myosin-Va



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	74.06Å 87.11Å 130.93Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.50 – 2.20 43.50 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.5 (43.50-2.20) 94.3 (43.50-2.20)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	0.97 (at 1.98Å)	Xtrriage
Refinement program	PHENIX 1.8.2_1309	Depositor
R, $R_{free}$	0.198 , 0.246 0.202 , 0.250	Depositor DCC
$R_{free}$ test set	2964 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	22.5	Xtrriage
Anisotropy	0.743	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 34.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	6441	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	25.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 44.44 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.5249e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<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

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	0.69	9/3087 (0.3%)	0.85	7/4161 (0.2%)
1	B	0.65	3/3081 (0.1%)	0.85	6/4153 (0.1%)
All	All	0.67	12/6168 (0.2%)	0.85	13/8314 (0.2%)

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1461	GLY	C-N	6.75	1.42	1.34
1	A	1515	MET	C-O	-6.30	1.16	1.24
1	A	1488	VAL	C-O	-6.11	1.16	1.24
1	A	1518	ARG	CA-C	6.10	1.60	1.52
1	A	1484	GLU	C-O	-5.95	1.17	1.24
1	B	1490	ASN	C-O	-5.38	1.17	1.24
1	A	1481	LYS	C-O	-5.31	1.17	1.24
1	A	1518	ARG	C-O	-5.22	1.18	1.24
1	B	1467	PRO	N-CD	5.20	1.55	1.47
1	A	1467	PRO	N-CD	5.10	1.54	1.47
1	B	1488	VAL	C-O	-5.10	1.17	1.24
1	A	1841	ILE	C-O	-5.05	1.18	1.24

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1466	MET	C-N-CD	8.22	138.68	120.60
1	B	1466	MET	C-N-CD	8.05	138.32	120.60
1	B	1707	ARG	N-CA-C	7.43	120.92	108.13
1	A	1461	GLY	CA-C-N	-6.63	112.86	119.56
1	A	1461	GLY	C-N-CA	-6.63	112.86	119.56
1	A	1843	ILE	N-CA-C	6.46	114.29	107.76
1	B	1496	LYS	CA-C-N	5.77	125.44	119.56
1	B	1496	LYS	C-N-CA	5.77	125.44	119.56
1	B	1696	ILE	CB-CA-C	-5.63	104.77	111.97
1	A	1496	LYS	CA-C-N	5.54	125.21	119.56

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1496	LYS	C-N-CA	5.54	125.21	119.56
1	B	1843	ILE	N-CA-C	5.22	113.03	107.76
1	A	1707	ARG	N-CA-C	5.07	116.65	108.34

There are no chirality outliers.

There are no planarity outliers.

## 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	3033	0	3106	25	0
1	B	3030	0	3101	21	0
2	A	183	0	0	2	0
2	B	195	0	0	0	0
All	All	6441	0	6207	46	0

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 4.

All (46) 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)
1:A:1836:LEU:HD21	1:A:1841:ILE:HD11	1.42	0.97
1:B:1547:ARG:HG2	1:B:1547:ARG:HH11	1.32	0.94
1:A:1466:MET:HG3	1:A:1467:PRO:HA	1.61	0.80
1:B:1550:ASP:OD2	1:B:1553:THR:HG23	1.88	0.74
1:A:1838:LEU:HA	1:A:1841:ILE:HD12	1.74	0.68
1:B:1547:ARG:HG2	1:B:1547:ARG:NH1	2.00	0.65
1:A:1836:LEU:CD2	1:A:1841:ILE:HD11	2.24	0.63
1:A:1584:ARG:NH1	2:A:2045:HOH:O	2.33	0.62
1:B:1512:ILE:HA	1:B:1515:MET:HE2	1.81	0.61
1:A:1617:LEU:HD13	1:A:1692:MET:HG2	1.84	0.59
1:B:1617:LEU:HD13	1:B:1692:MET:HG2	1.84	0.58
1:B:1488:VAL:HG22	1:B:1492:ILE:HD12	1.87	0.56
1:A:1466:MET:CG	1:A:1467:PRO:HA	2.33	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1692:MET:O	1:A:1696:ILE:HG12	2.08	0.54
1:A:1836:LEU:HD21	1:A:1841:ILE:CD1	2.27	0.54
1:B:1481:LYS:HG2	1:B:1528:LYS:HE3	1.90	0.53
1:B:1605:LEU:O	1:B:1609:ILE:HG13	2.09	0.53
1:A:1672:HIS:CE1	1:A:1733:LYS:HD2	2.44	0.52
1:B:1477:LEU:HD11	1:B:1515:MET:HE3	1.92	0.52
1:B:1548:GLY:HA3	1:B:1612:GLN:OE1	2.10	0.52
1:B:1515:MET:HE1	1:B:1841:ILE:HG21	1.93	0.51
1:A:1705:LEU:O	1:A:1781:LYS:HD3	2.11	0.51
1:A:1618:GLU:HG3	1:A:1695:ILE:HD13	1.94	0.50
1:B:1491:LEU:HD11	1:B:1512:ILE:HG22	1.92	0.50
1:B:1836:LEU:HD21	1:B:1841:ILE:HD11	1.94	0.50
1:B:1547:ARG:NH1	1:B:1547:ARG:CG	2.73	0.50
1:A:1486:LYS:HE3	1:A:1851:PHE:CE1	2.47	0.49
1:B:1512:ILE:HA	1:B:1515:MET:CE	2.42	0.48
1:A:1466:MET:HA	1:A:1467:PRO:C	2.38	0.47
1:B:1477:LEU:CD1	1:B:1515:MET:HE3	2.45	0.47
1:A:1548:GLY:HA3	1:A:1612:GLN:OE1	2.14	0.47
1:A:1486:LYS:HE3	1:A:1851:PHE:CD1	2.50	0.46
1:A:1746:PRO:HG2	1:A:1819:MET:HE1	1.98	0.45
1:A:1544:LEU:HD22	1:A:1544:LEU:HA	1.85	0.45
1:B:1496:LYS:HA	1:B:1497:PRO:HD3	1.82	0.45
1:B:1491:LEU:HD11	1:B:1512:ILE:CG2	2.48	0.44
1:A:1844:PRO:HG2	1:A:1847:LEU:HG	1.99	0.44
1:B:1692:MET:O	1:B:1696:ILE:HG12	2.19	0.42
1:B:1514:PHE:CZ	1:B:1571:TYR:HB2	2.54	0.41
1:A:1544:LEU:HD13	1:A:1612:GLN:OE1	2.20	0.41
1:A:1496:LYS:HA	1:A:1497:PRO:HD3	1.83	0.41
1:A:1550:ASP:OD2	1:A:1553:THR:HG23	2.21	0.41
1:B:1479:TYR:HB3	1:B:1852:ILE:HD12	2.02	0.40
1:A:1597:GLU:HG2	2:A:1991:HOH:O	2.21	0.40
1:A:1723:VAL:HG11	1:A:1748:ILE:HG12	2.03	0.40
1:A:1795:ARG:HE	1:A:1795:ARG:HB2	1.72	0.40

There are no symmetry-related clashes.

## 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	374/395 (95%)	369 (99%)	5 (1%)	0	100	100
1	B	373/395 (94%)	371 (100%)	2 (0%)	0	100	100
All	All	747/790 (95%)	740 (99%)	7 (1%)	0	100	100

There are no Ramachandran outliers to report.

### 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	346/359 (96%)	333 (96%)	13 (4%)	29	40
1	B	345/359 (96%)	338 (98%)	7 (2%)	48	64
All	All	691/718 (96%)	671 (97%)	20 (3%)	37	51

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1470	GLU
1	A	1489	LYS
1	A	1495	LEU
1	A	1544	LEU
1	A	1575	GLU
1	A	1597	GLU
1	A	1618	GLU
1	A	1638	VAL

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Mol	Chain	Res	Type
1	A	1658	THR
1	A	1708	LYS
1	A	1736	MET
1	A	1781	LYS
1	A	1842	GLN
1	B	1486	LYS
1	B	1488	VAL
1	B	1542	LYS
1	B	1549	ASP
1	B	1603	SER
1	B	1703	ASN
1	B	1807	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1600	GLN
1	A	1725	GLN
1	A	1784	ASN
1	A	1842	GLN
1	B	1636	GLN
1	B	1718	GLN

### 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 oligosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 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	377/395 (95%)	-0.09	4 (1%) 78 76	14, 24, 39, 58	1 (0%)
1	B	377/395 (95%)	-0.14	3 (0%) 82 80	13, 23, 37, 49	0
All	All	754/790 (95%)	-0.11	7 (0%) 81 79	13, 23, 38, 58	1 (0%)

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1461	GLY	5.7
1	B	1544	LEU	2.7
1	A	1632	HIS	2.6
1	A	1639	SER	2.3
1	A	1635	ILE	2.3
1	B	1482	GLU	2.1
1	B	1639	SER	2.1

### 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 oligosaccharides in this entry.

### 6.4 Ligands [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.