



# wwPDB X-ray Structure Validation Summary Report ⓘ

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PDB ID : 3TUY  
Title : Phosphorylated Light Chain Domain of Scallop smooth Muscle Myosin  
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Deposited on : 2011-09-19  
Resolution : 2.50 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  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.35  
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

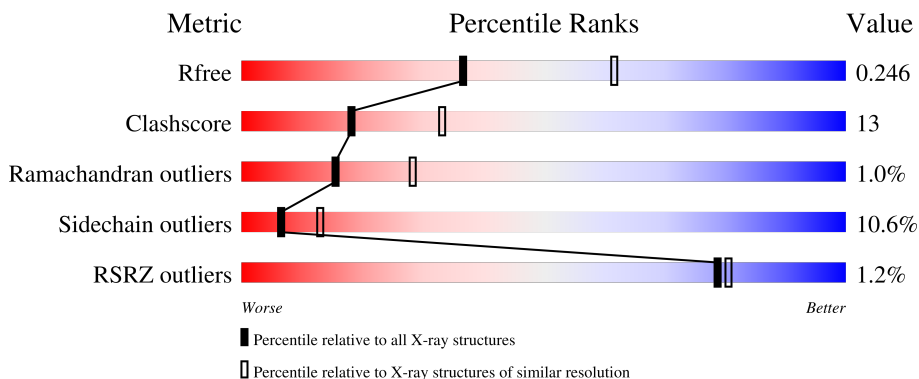
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 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.



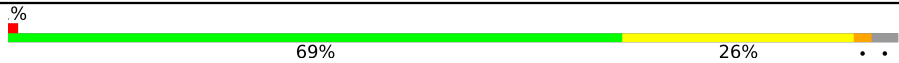
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)

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	69	
1	D	69	
2	B	161	
2	E	161	
3	C	156	

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Mol	Chain	Length	Quality of chain
3	F	156	 <p>A horizontal bar chart representing the quality of chain. The bar is divided into two segments: a green segment on the left labeled '69%' and a yellow segment on the right labeled '26%'. A small red square is at the beginning of the bar, and two small black dots are at the end. A '%' symbol is positioned above the start of the bar.</p>

## 2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 6059 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 Myosin heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	69	606	396	115	93	2	0	0	0
1	D	69	606	396	115	93	2	0	0	0

- Molecule 2 is a protein called Myosin regulatory light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	141	1135	718	183	223	11	0	0	0
2	E	146	1176	742	189	233	1 11	0	0	0

- Molecule 3 is a protein called Myosin essential light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	152	1210	764	192	247	7	0	0	0
3	F	151	1198	755	191	245	7	0	0	0

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	1	Total Mg 1 1	0	0
4	E	1	Total Mg 1 1	0	0

- Molecule 5 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	C	1	Total Ca 1 1	0	0
5	F	1	Total Ca 1 1	0	0

- Molecule 6 is water.

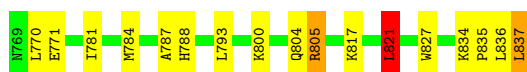
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	14	Total O 14 14	0	0
6	B	35	Total O 35 35	0	0
6	C	32	Total O 32 32	0	0
6	D	6	Total O 6 6	0	0
6	E	16	Total O 16 16	0	0
6	F	21	Total O 21 21	0	0

### 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: Myosin heavy chain

Chain A:  75% 20% ..



- Molecule 1: Myosin heavy chain

Chain D:  70% 29% ..



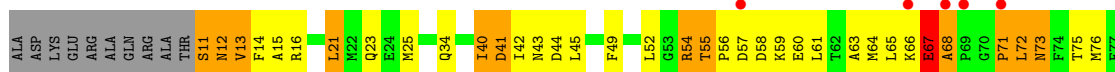
- Molecule 2: Myosin regulatory light chain

Chain B:  2% 63% 22% .. 12%




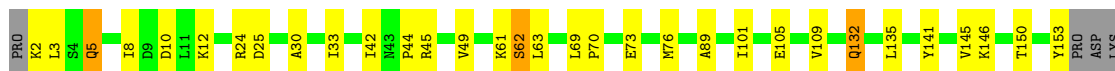
- Molecule 2: Myosin regulatory light chain

Chain E:  3% 57% 24% 9% .. 9%

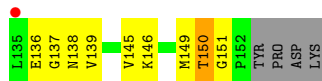


- Molecule 3: Myosin essential light chain

Chain C:  77% 19% ..



- Molecule 3: Myosin essential light chain



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	50.95Å 69.23Å 79.50Å 77.20° 85.99° 73.44°	Depositor
Resolution (Å)	48.83 – 2.50 48.83 – 2.50	Depositor EDS
% Data completeness (in resolution range)	93.4 (48.83-2.50) 93.4 (48.83-2.50)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.71 (at 2.51Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.6.4_486)	Depositor
R, $R_{free}$	0.200 , 0.252 0.195 , 0.246	Depositor DCC
$R_{free}$ test set	2000 reflections (5.78%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	40.3	Xtrriage
Anisotropy	0.262	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 35.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	6059	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	48.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.86% 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: MG, SEP, CA

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	0.49	0/619	0.63	1/829 (0.1%)
1	D	0.43	0/619	0.53	0/829
2	B	0.48	0/1153	0.66	1/1540 (0.1%)
2	E	0.45	0/1185	0.59	0/1584
3	C	0.51	0/1233	0.63	0/1658
3	F	0.47	0/1220	0.62	0/1640
All	All	0.47	0/6029	0.62	2/8080 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	821	LEU	CA-CB-CG	5.84	128.74	115.30
2	B	37	ASP	CB-CA-C	-5.29	99.83	110.40

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	606	0	649	14	0
1	D	606	0	649	9	0
2	B	1135	0	1118	28	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	E	1176	0	1153	65	0
3	C	1210	0	1134	20	0
3	F	1198	0	1125	32	0
4	B	1	0	0	0	0
4	E	1	0	0	0	0
5	C	1	0	0	0	0
5	F	1	0	0	0	0
6	A	14	0	0	2	0
6	B	35	0	0	0	0
6	C	32	0	0	1	0
6	D	6	0	0	0	0
6	E	16	0	0	1	0
6	F	21	0	0	0	0
All	All	6059	0	5828	158	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 13.

The worst 5 of 158 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)
2:B:17:LEU:HD21	2:B:86:SER:CB	1.62	1.27
2:B:17:LEU:CD2	2:B:86:SER:HB2	1.67	1.22
2:E:13:VAL:HA	2:E:16:ARG:NH2	1.55	1.20
3:C:5:GLN:HA	3:C:5:GLN:HE21	1.06	1.11
2:E:13:VAL:HG12	2:E:16:ARG:HH21	1.21	1.04

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	67/69 (97%)	67 (100%)	0	0	100	100
1	D	67/69 (97%)	67 (100%)	0	0	100	100
2	B	139/161 (86%)	133 (96%)	6 (4%)	0	100	100
2	E	144/161 (89%)	131 (91%)	9 (6%)	4 (3%)	5	7
3	C	150/156 (96%)	148 (99%)	1 (1%)	1 (1%)	22	39
3	F	149/156 (96%)	139 (93%)	8 (5%)	2 (1%)	12	21
All	All	716/772 (93%)	685 (96%)	24 (3%)	7 (1%)	15	28

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	E	68	ALA
2	E	71	PRO
3	F	97	GLY
3	F	103	GLY
3	C	25	ASP

### 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	64/64 (100%)	58 (91%)	6 (9%)	8	17
1	D	64/64 (100%)	56 (88%)	8 (12%)	4	8
2	B	126/139 (91%)	107 (85%)	19 (15%)	3	5
2	E	129/139 (93%)	112 (87%)	17 (13%)	4	7
3	C	129/133 (97%)	117 (91%)	12 (9%)	9	17
3	F	128/133 (96%)	122 (95%)	6 (5%)	26	49
All	All	640/672 (95%)	572 (89%)	68 (11%)	6	13

5 of 68 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	E	73	ASN

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Mol	Chain	Res	Type
2	E	85	LEU
3	F	101	ILE
2	B	156	SER
2	B	148	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
3	C	138	ASN
2	E	12	ASN
2	E	120	ASN
2	E	73	ASN
2	B	96	ASN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
2	SEP	E	11	2	8,9,10	1.53	1 (12%)	8,12,14	1.70	2 (25%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	SEP	E	11	2	-	4/5/8/10	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	E	11	SEP	P-O1P	3.32	1.61	1.50

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	E	11	SEP	P-OG-CB	-3.21	109.46	118.30
2	E	11	SEP	OG-CB-CA	3.04	111.10	108.14

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	E	11	SEP	N-CA-CB-OG
2	E	11	SEP	CB-OG-P-O1P
2	E	11	SEP	CB-OG-P-O2P
2	E	11	SEP	CB-OG-P-O3P

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	E	11	SEP	1	0

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 4 are 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	69/69 (100%)	-0.31	0	100   100	25, 36, 61, 70	0
1	D	69/69 (100%)	-0.32	0	100   100	32, 43, 79, 84	0
2	B	141/161 (87%)	-0.24	3 (2%)	63   66	28, 40, 63, 76	0
2	E	145/161 (90%)	0.08	5 (3%)	45   48	32, 55, 93, 102	0
3	C	152/156 (97%)	-0.33	0	100   100	28, 41, 60, 73	0
3	F	151/156 (96%)	-0.19	1 (0%)	87   89	29, 47, 94, 106	0
All	All	727/772 (94%)	-0.20	9 (1%)	79   80	25, 43, 81, 106	0

The worst 5 of 9 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	F	135	LEU	5.3
2	E	68	ALA	4.0
2	B	16	ARG	3.9
2	B	156	SER	3.5
2	E	71	PRO	2.7

### 6.2 Non-standard residues in protein, DNA, RNA chains [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(Å <sup>2</sup> )	Q<0.9
2	SEP	E	11	10/11	0.80	0.21	94,99,106,118	0

### 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(Å <sup>2</sup> )	Q<0.9
4	MG	E	162	1/1	0.80	0.05	67,67,67,67	0
5	CA	C	157	1/1	0.89	0.06	59,59,59,59	0
5	CA	F	157	1/1	0.90	0.06	52,52,52,52	0
4	MG	B	162	1/1	0.91	0.20	35,35,35,35	0

### 6.5 Other polymers [i](#)

There are no such residues in this entry.