



Full wwPDB X-ray Structure Validation Report ⓘ

May 26, 2020 – 10:59 am BST

PDB ID : 3V42
Title : Crystal structure of renal tumor suppressor protein, folliculin
Authors : Nookala, R.K.; Chirgadze, D.Y.; Blundell, T.L.
Deposited on : 2011-12-14
Resolution : 2.00 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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Xtrriage (Phenix) : 1.13
EDS : 2.11
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) : 2.11

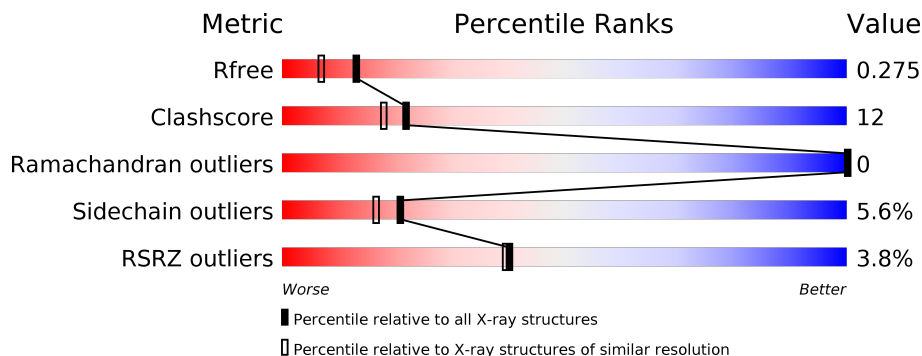
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 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	226	 5% 65% 19% • 13%
1	B	226	 2% 68% 17% • 12%

2 Entry composition i

There are 2 unique types of molecules in this entry. The entry contains 3308 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 Folliculin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	196	1540	998	261	273	8	0	0	0
1	B	199	1544	1000	261	275	8	0	1	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	454	ALA	CYS	ENGINEERED MUTATION	UNP Q8NFG4
A	503	ALA	CYS	ENGINEERED MUTATION	UNP Q8NFG4
A	506	ALA	CYS	ENGINEERED MUTATION	UNP Q8NFG4
B	454	ALA	CYS	ENGINEERED MUTATION	UNP Q8NFG4
B	503	ALA	CYS	ENGINEERED MUTATION	UNP Q8NFG4
B	506	ALA	CYS	ENGINEERED MUTATION	UNP Q8NFG4

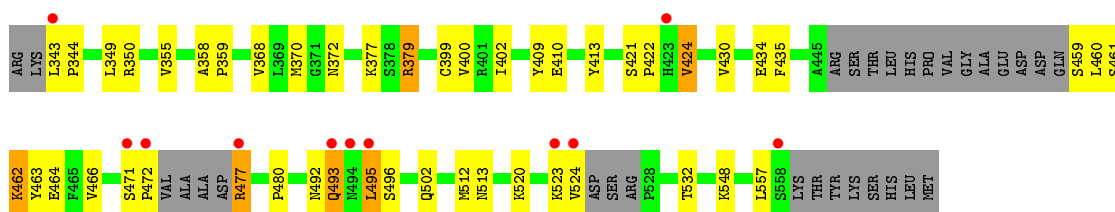
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	105	Total	O	0	0
			105	105		
2	B	119	Total	O	0	0
			119	119		

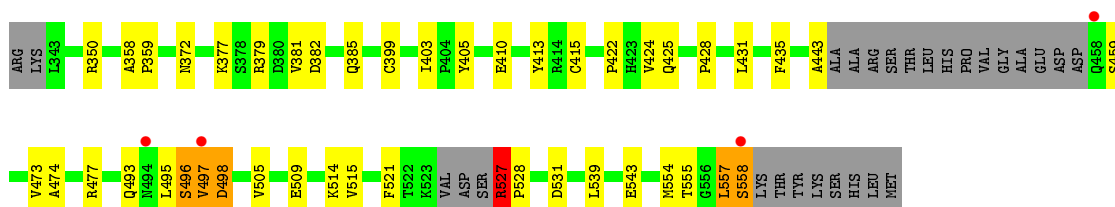
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: Folliculin



- Molecule 1: Folliculin



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	86.05Å 99.95Å 107.58Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.14 – 2.00 29.14 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.0 (29.14-2.00) 99.0 (29.14-2.00)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.30 (at 2.00Å)	Xtrriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.204 , 0.268 0.215 , 0.275	Depositor DCC
R_{free} test set	1570 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	24.6	Xtrriage
Anisotropy	0.089	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 50.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3308	wwPDB-VP
Average B, all atoms (Å ²)	28.0	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 44.27 % 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 1.5627e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

²Theoretical 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

5.1 Standard geometry

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	1.59	8/1572 (0.5%)	0.83	1/2130 (0.0%)
1	B	1.64	3/1580 (0.2%)	0.86	2/2149 (0.1%)
All	All	1.62	11/3152 (0.3%)	0.85	3/4279 (0.1%)

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	413	TYR	CD2-CE2	-6.84	1.29	1.39
1	B	399	CYS	CB-SG	-6.79	1.70	1.82
1	A	410	GLU	CD-OE2	-6.05	1.19	1.25
1	A	424	VAL	CB-CG1	-5.93	1.40	1.52
1	B	410	GLU	CD-OE2	-5.72	1.19	1.25
1	A	368	VAL	CB-CG2	-5.65	1.41	1.52
1	A	413	TYR	CD1-CE1	-5.50	1.31	1.39
1	A	399	CYS	CB-SG	-5.38	1.73	1.81
1	B	413	TYR	CD1-CE1	-5.34	1.31	1.39
1	A	464	GLU	CD-OE2	-5.14	1.20	1.25
1	A	355	VAL	CB-CG1	-5.05	1.42	1.52

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	B	527	ARG	NE-CZ-NH1	-6.30	117.15	120.30
1	A	557	LEU	CA-CB-CG	5.84	128.74	115.30
1	B	382	ASP	CB-CG-OD2	5.52	123.27	118.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	1540	0	1574	37	1
1	B	1544	0	1542	36	0
2	A	105	0	0	8	5
2	B	119	0	0	8	6
All	All	3308	0	3116	73	6

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 12.

All (73) 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:523:LYS:O	1:A:524:VAL:HG23	1.41	1.18
1:A:512:MET:HG3	2:A:195:HOH:O	1.68	0.93
1:A:377:LYS:CE	1:A:422:PRO:O	2.16	0.92
1:A:350:ARG:HH22	1:A:495:LEU:HB2	1.32	0.91
1:A:377:LYS:HE2	1:A:422:PRO:O	1.69	0.90
1:A:477:ARG:HD2	1:A:477:ARG:N	1.86	0.89
1:B:428:PRO:HA	2:B:265:HOH:O	1.72	0.88
1:A:523:LYS:O	1:A:524:VAL:CG2	2.29	0.75
1:A:502:GLN:CG	2:A:191:HOH:O	2.34	0.74
1:B:555:THR:HA	1:B:558:SER:HB2	1.72	0.70
1:B:431:LEU:HD12	2:B:265:HOH:O	1.90	0.69
1:A:477:ARG:CD	1:A:477:ARG:N	2.54	0.69
1:B:377:LYS:CE	1:B:422:PRO:O	2.43	0.67
1:A:377:LYS:HE3	1:A:422:PRO:O	1.96	0.66
1:A:502:GLN:HG3	2:A:191:HOH:O	1.93	0.65
1:B:443:ALA:C	2:B:239:HOH:O	2.36	0.63
1:A:358:ALA:HB3	1:A:359:PRO:HD3	1.81	0.61
1:A:532:THR:HG23	2:A:104:HOH:O	2.00	0.61
1:A:502:GLN:HG2	2:A:191:HOH:O	1.98	0.61
1:B:514:LYS:HE2	1:B:539:LEU:O	2.00	0.61
1:B:557:LEU:C	1:B:557:LEU:HD12	2.21	0.60
1:B:350:ARG:HH22	1:B:495:LEU:HB2	1.67	0.59
1:B:377:LYS:HE2	1:B:422:PRO:O	2.03	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:505:VAL:O	1:B:509:GLU:HG3	2.04	0.57
1:B:496:SER:HB3	2:B:223:HOH:O	2.04	0.57
1:B:521:PHE:CZ	1:B:527:ARG:HG2	2.43	0.54
1:A:421:SER:HB2	1:A:424:VAL:HG23	1.91	0.52
1:A:370:MET:HE2	1:A:480:PRO:HD3	1.93	0.51
1:B:403:ILE:HG13	1:B:415:CYS:HB3	1.92	0.51
1:A:343:LEU:N	1:A:344:PRO:CD	2.75	0.50
1:B:557:LEU:CD1	1:B:557:LEU:C	2.80	0.50
1:A:459:SER:HB2	1:A:460:LEU:HD13	1.95	0.49
1:B:377:LYS:HE3	1:B:422:PRO:O	2.13	0.48
1:A:343:LEU:CB	2:A:135:HOH:O	2.62	0.48
1:B:424:VAL:HG12	1:B:425:GLN:N	2.28	0.48
1:A:493:GLN:O	1:A:493:GLN:OE1	2.32	0.47
1:A:492:ASN:HD22	1:A:495:LEU:HD23	1.79	0.47
1:B:521:PHE:CE2	1:B:527:ARG:HG2	2.50	0.47
1:B:381:VAL:HG22	1:B:405:TYR:CE2	2.50	0.47
1:B:557:LEU:HD12	1:B:558:SER:N	2.30	0.47
1:A:548:LYS:HD2	2:A:284:HOH:O	2.15	0.47
1:B:498:ASP:OD1	1:B:498:ASP:C	2.53	0.47
1:B:428:PRO:CA	2:B:265:HOH:O	2.47	0.46
1:A:459:SER:C	1:A:460:LEU:HD12	2.36	0.46
1:A:471:SER:HA	1:A:472:PRO:HD2	1.41	0.46
1:B:372:ASN:HB3	1:B:435:PHE:O	2.17	0.45
1:A:409:TYR:CZ	1:A:430:VAL:HG21	2.51	0.44
1:A:349:LEU:HA	1:A:349:LEU:HD23	1.83	0.43
1:B:493:GLN:CB	2:B:123:HOH:O	2.66	0.43
1:A:471:SER:O	1:A:472:PRO:C	2.56	0.43
1:B:358:ALA:HB3	1:B:359:PRO:HD3	1.99	0.43
1:B:424:VAL:CG1	1:B:425:GLN:N	2.81	0.43
1:A:350:ARG:HD3	1:A:493:GLN:HE22	1.84	0.42
1:B:515:VAL:CG1	1:B:554:MET:HG3	2.49	0.42
1:B:477:ARG:CZ	2:B:218:HOH:O	2.67	0.42
1:B:497:VAL:CG1	1:B:498:ASP:N	2.82	0.42
1:B:473:VAL:O	1:B:474:ALA:HB3	2.20	0.42
1:B:527:ARG:HD2	1:B:527:ARG:HH11	1.59	0.42
1:A:462:LYS:HD3	1:A:463:TYR:CD2	2.55	0.42
1:A:466:VAL:HG12	2:A:183:HOH:O	2.20	0.41
1:B:381:VAL:HG22	1:B:405:TYR:CZ	2.55	0.41
1:A:462:LYS:HD3	1:A:463:TYR:CE2	2.55	0.41
1:A:372:ASN:HB3	1:A:435:PHE:O	2.19	0.41
1:A:520:LYS:O	1:A:523:LYS:HB2	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:527:ARG:HD3	1:B:527:ARG:HA	1.32	0.41
1:A:379:ARG:HG3	1:A:422:PRO:HG2	2.01	0.41
1:B:385:GLN:NE2	2:B:295:HOH:O	2.37	0.41
1:A:492:ASN:HD22	1:A:495:LEU:CD2	2.34	0.41
1:B:495:LEU:HD23	1:B:495:LEU:HA	1.61	0.41
1:A:400:VAL:CG1	1:A:402:ILE:HD11	2.51	0.40
1:A:462:LYS:HG3	1:A:462:LYS:H	1.53	0.40
1:B:497:VAL:HG12	1:B:498:ASP:N	2.36	0.40
1:B:527:ARG:HG3	1:B:531:ASP:HB2	2.03	0.40

All (6) 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)
2:A:179:HOH:O	2:B:218:HOH:O[6_655]	1.47	0.73
2:A:199:HOH:O	2:B:254:HOH:O[7_645]	1.78	0.42
1:A:463:TYR:O	2:B:217:HOH:O[6_655]	1.80	0.40
2:A:132:HOH:O	2:B:217:HOH:O[6_655]	1.86	0.34
2:A:161:HOH:O	2:B:219:HOH:O[6_655]	1.92	0.28
2:A:181:HOH:O	2:B:99:HOH:O[6_655]	1.97	0.23

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	188/226 (83%)	186 (99%)	2 (1%)	0	100	100
1	B	194/226 (86%)	190 (98%)	4 (2%)	0	100	100
All	All	382/452 (84%)	376 (98%)	6 (2%)	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	172/201 (86%)	163 (95%)	9 (5%)	23	19
1	B	167/201 (83%)	157 (94%)	10 (6%)	19	14
All	All	339/402 (84%)	320 (94%)	19 (6%)	21	17

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	379	ARG
1	A	434	GLU
1	A	461	SER
1	A	462	LYS
1	A	477	ARG
1	A	493	GLN
1	A	495	LEU
1	A	496	SER
1	A	513	ASN
1	B	379	ARG
1	B	459	SER
1	B	496	SER
1	B	497	VAL
1	B	498	ASP
1	B	527	ARG
1	B	528	PRO
1	B	543	GLU
1	B	557	LEU
1	B	558	SER

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

Mol	Chain	Res	Type
1	A	372	ASN
1	A	373	GLN
1	A	429	HIS

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Mol	Chain	Res	Type
1	A	492	ASN
1	A	493	GLN
1	B	372	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](#)

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

5.5 Carbohydrates [i](#)

There are no carbohydrates 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, 95th 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 ²)	Q<0.9
1	A	196/226 (86%)	0.08	11 (5%) 24 23	14, 27, 53, 64	1 (0%)
1	B	199/226 (88%)	0.03	4 (2%) 65 63	13, 26, 48, 64	2 (1%)
All	All	395/452 (87%)	0.05	15 (3%) 40 39	13, 26, 51, 64	3 (0%)

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	458	GLN	9.4
1	A	343	LEU	5.9
1	A	524	VAL	5.3
1	B	558	SER	4.5
1	A	494	ASN	4.3
1	A	477	ARG	3.4
1	A	523	LYS	3.3
1	A	472	PRO	3.2
1	B	494	ASN	2.9
1	A	558	SER	2.9
1	A	493	GLN	2.7
1	A	495	LEU	2.6
1	B	497	VAL	2.5
1	A	471	SER	2.1
1	A	423	HIS	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 carbohydrates in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.