Full wwPDB X-ray Structure Validation Report (i)

Feb 19, 2016 – 07:27 PM GMT

PDB ID	:	4UFS
Title	:	Low resolution structure R-spondin-2 (Fu1Fu2) in complex with the ectodomains of LGR5 and ZNRF3
Authors	:	Zebisch, M.; Jones, E.Y.
Deposited on	:	2015-03-18
Resolution	:	4.80 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
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

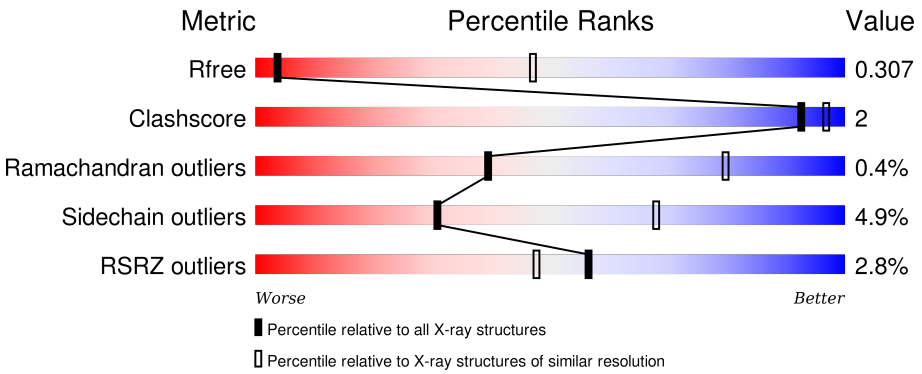
MolProbity	:	4.02b-467
Mogul	:	unknown
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026982
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20026982

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 4.80 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}	91344	1117 (6.00-3.60)
Clashscore	102246	1017 (5.96-3.64)
Ramachandran outliers	100387	1156 (6.00-3.60)
Sidechain outliers	100360	1134 (6.00-3.60)
RSRZ outliers	91569	1120 (6.00-3.60)

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. 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 <=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	484	3% 85% 9% • 5%
2	B	120	4% 79% 6% • 14%
3	C	165	90% • 7%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 5582 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 LEUCINE-RICH REPEAT-CONTAINING G-PROTEIN COUPLED RECEPTOR 5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	460	3607	2299	622	669	17	0	0	0

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	29	GLU	-	EXPRESSION TAG	UNP O75473
A	30	THR	-	EXPRESSION TAG	UNP O75473
A	31	LEU	-	EXPRESSION TAG	UNP O75473
A	488	ASN	-	LINKER	UNP O75473
A	489	ASN	-	LINKER	UNP O75473
A	490	GLY	-	LINKER	UNP O75473
A	491	ASN	-	LINKER	UNP O75473
A	492	ASN	-	LINKER	UNP O75473
A	493	GLY	-	LINKER	UNP O75473
A	494	ASP	-	LINKER	UNP O75473
A	545	GLY	-	EXPRESSION TAG	UNP O75473
A	546	THR	-	EXPRESSION TAG	UNP O75473
A	547	HIS	-	EXPRESSION TAG	UNP O75473
A	548	HIS	-	EXPRESSION TAG	UNP O75473
A	549	HIS	-	EXPRESSION TAG	UNP O75473
A	550	HIS	-	EXPRESSION TAG	UNP O75473
A	551	HIS	-	EXPRESSION TAG	UNP O75473
A	552	HIS	-	EXPRESSION TAG	UNP O75473
A	553	HIS	-	EXPRESSION TAG	UNP O75473
A	554	HIS	-	EXPRESSION TAG	UNP O75473
A	555	HIS	-	EXPRESSION TAG	UNP O75473
A	556	HIS	-	EXPRESSION TAG	UNP O75473

- Molecule 2 is a protein called R-SPONDIN-2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	103	797	488	147	143	19	0	0	0

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	36	GLU	-	EXPRESSION TAG	UNP Q8BFU0
B	37	THR	-	EXPRESSION TAG	UNP Q8BFU0
B	38	GLY	-	EXPRESSION TAG	UNP Q8BFU0
B	145	THR	-	EXPRESSION TAG	UNP Q8BFU0
B	146	HIS	-	EXPRESSION TAG	UNP Q8BFU0
B	147	HIS	-	EXPRESSION TAG	UNP Q8BFU0
B	148	HIS	-	EXPRESSION TAG	UNP Q8BFU0
B	149	HIS	-	EXPRESSION TAG	UNP Q8BFU0
B	150	HIS	-	EXPRESSION TAG	UNP Q8BFU0
B	151	HIS	-	EXPRESSION TAG	UNP Q8BFU0
B	152	HIS	-	EXPRESSION TAG	UNP Q8BFU0
B	153	HIS	-	EXPRESSION TAG	UNP Q8BFU0
B	154	HIS	-	EXPRESSION TAG	UNP Q8BFU0
B	155	HIS	-	EXPRESSION TAG	UNP Q8BFU0

- Molecule 3 is a protein called E3 UBIQUITIN-PROTEIN LIGASE ZNRF3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	153	1178	740	205	228	5	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

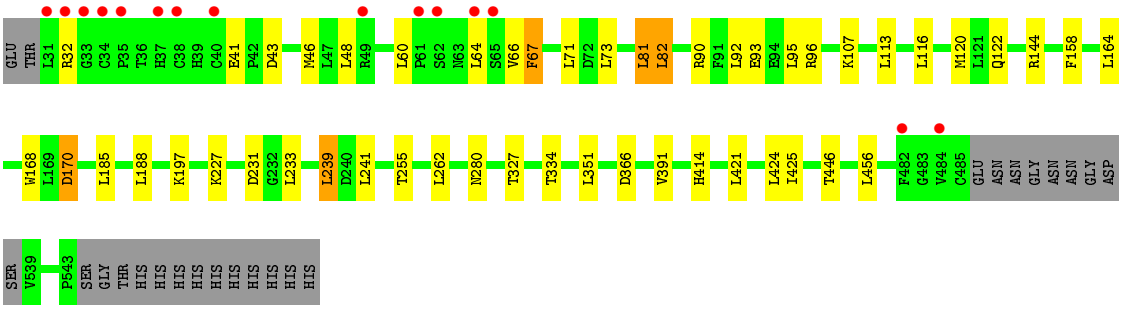
Chain	Residue	Modelled	Actual	Comment	Reference
C	50	GLU	-	EXPRESSION TAG	UNP Q5SSZ7
C	51	THR	-	EXPRESSION TAG	UNP Q5SSZ7
C	52	GLY	-	EXPRESSION TAG	UNP Q5SSZ7
C	206	GLY	-	EXPRESSION TAG	UNP Q5SSZ7
C	207	THR	-	EXPRESSION TAG	UNP Q5SSZ7
C	208	LYS	-	EXPRESSION TAG	UNP Q5SSZ7
C	209	HIS	-	EXPRESSION TAG	UNP Q5SSZ7
C	210	HIS	-	EXPRESSION TAG	UNP Q5SSZ7
C	211	HIS	-	EXPRESSION TAG	UNP Q5SSZ7
C	212	HIS	-	EXPRESSION TAG	UNP Q5SSZ7
C	213	HIS	-	EXPRESSION TAG	UNP Q5SSZ7
C	214	HIS	-	EXPRESSION TAG	UNP Q5SSZ7

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 errors 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.

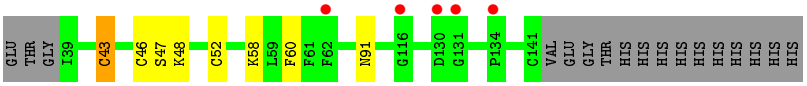
• Molecule 1: LEUCINE-RICH REPEAT-CONTAINING G-PROTEIN COUPLED RECEPTOR 5

Chain A:



• Molecule 2: R-SPONDIN-2

Chain B:



• Molecule 3: E3 UBIQUITIN-PROTEIN LIGASE ZNRF3

Chain C:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	I 4 2 2	Depositor
Cell constants a, b, c, α, β, γ	188.61Å 188.61Å 165.29Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	133.37 – 4.80 39.47 – 4.80	Depositor EDS
% Data completeness (in resolution range)	98.9 (133.37-4.80) 99.2 (39.47-4.80)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.57 (at 4.84Å)	Xtriage
Refinement program	REFMAC 5.8.0073	Depositor
R, R_{free}	0.270 , 0.313 0.267 , 0.307	Depositor DCC
R_{free} test set	393 reflections (5.52%)	DCC
Wilson B-factor (Å^2)	199.8	Xtriage
Anisotropy	0.069	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.28 , 223.5	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.43$, $< L^2 > = 0.26$	Xtriage
Outliers	0 of 7509 reflections	Xtriage
F_o,F_c correlation	0.90	EDS
Total number of atoms	5582	wwPDB-VP
Average B, all atoms (Å^2)	257.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.22% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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	0.27	0/3687	0.47	0/5020
2	B	0.28	0/815	0.46	0/1087
3	C	0.26	0/1198	0.43	0/1623
All	All	0.27	0/5700	0.46	0/7730

There are no bond length outliers.

There are no bond angle outliers.

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	3607	0	3617	17	0
2	B	797	0	717	3	0
3	C	1178	0	1178	2	0
All	All	5582	0	5512	22	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 2.

All (22) 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:81:LEU:HB2	1:A:82:LEU:HD12	1.81	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:66:VAL:O	1:A:67:PHE:HB2	2.01	0.59
1:A:164:LEU:HD23	1:A:185:LEU:HD22	1.87	0.57
1:A:60:LEU:HD22	1:A:73:LEU:HD13	1.84	0.56
3:C:155:VAL:HG21	3:C:179:TYR:HB2	1.88	0.54
1:A:158:PHE:HB3	1:A:185:LEU:HD21	1.91	0.52
1:A:391:VAL:HG22	1:A:414:HIS:CG	2.46	0.51
1:A:170:ASP:N	1:A:170:ASP:OD1	2.45	0.49
1:A:185:LEU:HD13	1:A:188:LEU:HD11	1.94	0.49
1:A:239:LEU:HD22	1:A:241:LEU:HG	1.94	0.48
1:A:144:ARG:HG2	1:A:168:TRP:CE3	2.50	0.47
1:A:96:ARG:HA	1:A:120:MET:HB2	1.97	0.47
1:A:231:ASP:HA	1:A:255:THR:HG21	1.96	0.46
1:A:60:LEU:HG	1:A:82:LEU:HD11	1.98	0.45
2:B:60:PHE:CD2	2:B:91:ASN:HB3	2.52	0.45
1:A:60:LEU:CD1	1:A:82:LEU:HD11	2.47	0.43
1:A:421:LEU:HD22	1:A:424:LEU:HD12	2.00	0.43
2:B:46:CYS:SG	2:B:47:SER:N	2.92	0.43
1:A:425:ILE:HB	1:A:446:THR:HG22	2.01	0.43
3:C:57:PHE:CE1	3:C:205:LEU:HD12	2.54	0.42
1:A:81:LEU:HD22	1:A:81:LEU:O	2.20	0.42
2:B:43:CYS:HB3	2:B:52:CYS:HB3	2.01	0.41

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	456/484 (94%)	403 (88%)	50 (11%)	3 (1%)	26 71
2	B	101/120 (84%)	94 (93%)	7 (7%)	0	100 100
3	C	151/165 (92%)	147 (97%)	4 (3%)	0	100 100
All	All	708/769 (92%)	644 (91%)	61 (9%)	3 (0%)	39 80

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	43	ASP
1	A	67	PHE
1	A	32	ARG

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	416/438 (95%)	389 (94%)	27 (6%)	21 60
2	B	86/106 (81%)	83 (96%)	3 (4%)	43 76
3	C	128/138 (93%)	127 (99%)	1 (1%)	86 93
All	All	630/682 (92%)	599 (95%)	31 (5%)	31 68

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	41	GLU
1	A	46	MET
1	A	48	LEU
1	A	64	LEU
1	A	71	LEU
1	A	81	LEU
1	A	82	LEU
1	A	90	ARG
1	A	92	LEU
1	A	93	GLU
1	A	95	LEU
1	A	107	LYS
1	A	113	LEU
1	A	116	LEU
1	A	122	GLN
1	A	170	ASP
1	A	197	LYS
1	A	227	LYS

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Mol	Chain	Res	Type
1	A	233	LEU
1	A	239	LEU
1	A	262	LEU
1	A	280	ASN
1	A	327	THR
1	A	334	THR
1	A	351	LEU
1	A	366	ASP
1	A	456	LEU
2	B	43	CYS
2	B	48	LYS
2	B	58	LYS
3	C	175	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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	460/484 (95%)	-0.21	15 (3%) 50 41	133, 238, 346, 473	0
2	B	103/120 (85%)	0.12	5 (4%) 33 28	206, 272, 371, 420	0
3	C	153/165 (92%)	-0.33	0 100 100	175, 269, 350, 408	0
All	All	716/769 (93%)	-0.19	20 (2%) 56 48	133, 251, 355, 473	0

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	31	LEU	5.0
2	B	131	GLY	3.7
1	A	34	CYS	3.1
1	A	33	GLY	3.0
1	A	65	SER	2.9
2	B	62	PHE	2.9
1	A	37	HIS	2.9
2	B	116	GLY	2.7
1	A	482	PHE	2.6
2	B	130	ASP	2.6
1	A	40	CYS	2.6
1	A	38	CYS	2.5
1	A	64	LEU	2.5
1	A	35	PRO	2.5
1	A	484	VAL	2.4
1	A	61	PRO	2.4
1	A	32	ARG	2.4
1	A	49	ARG	2.3
1	A	62	SER	2.3
2	B	134	PRO	2.2

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 (i)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.