Full wwPDB X-ray Structure Validation Report ⓘ

May 15, 2020 – 10:25 am BST

PDB ID	:	4QXF
Title	:	crystal structure of human LGR4 and Rspo1
Authors	:	Xu, J.G.; Huang, C.; Zhou, Y.; Zhu, Y.
Deposited on	:	2014-07-20
Resolution	:	2.25 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:

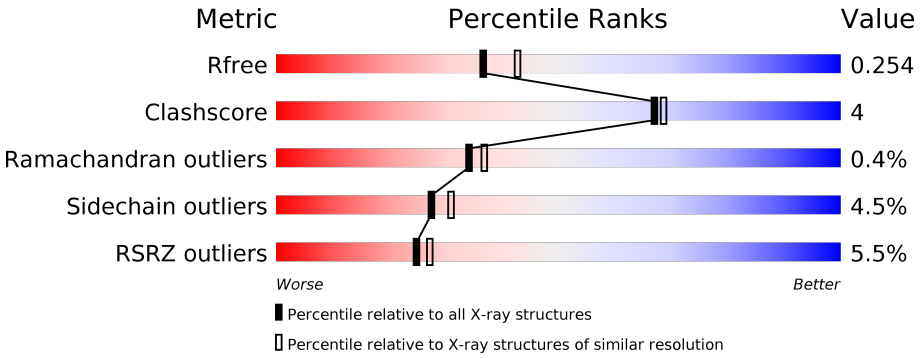
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.25 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	1377 (2.26-2.26)
Clashscore	141614	1487 (2.26-2.26)
Ramachandran outliers	138981	1449 (2.26-2.26)
Sidechain outliers	138945	1450 (2.26-2.26)
RSRZ outliers	127900	1356 (2.26-2.26)

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 <=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	301	3% 90% 8%
1	B	301	2% 89% 11%
2	C	102	10% 63% 13% 23%
2	E	102	15% 64% 11% 24%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6122 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 4, Variable lymphocyte receptor B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	300	Total	C	N	O	S	0	0	0
			2319	1463	401	444	11			
1	B	301	Total	C	N	O	S	0	0	0
			2326	1467	402	446	11			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	25	MET	-	EXPRESSION TAG	UNP Q9BXB1
A	26	ASP	-	EXPRESSION TAG	UNP Q9BXB1
A	75	GLY	ASP	ENGINEERED MUTATION	UNP Q9BXB1
B	25	MET	-	EXPRESSION TAG	UNP Q9BXB1
B	26	ASP	-	EXPRESSION TAG	UNP Q9BXB1
B	75	GLY	ASP	ENGINEERED MUTATION	UNP Q9BXB1

- Molecule 2 is a protein called R-spondin-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	E	78	Total	C	N	O	S	0	0	0
			607	385	108	101	13			
2	C	79	Total	C	N	O	S	0	0	0
			607	384	108	102	13			

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	106	Total	O	0	0
			106	106		
3	B	113	Total	O	0	0
			113	113		

Continued on next page...

Continued from previous page...

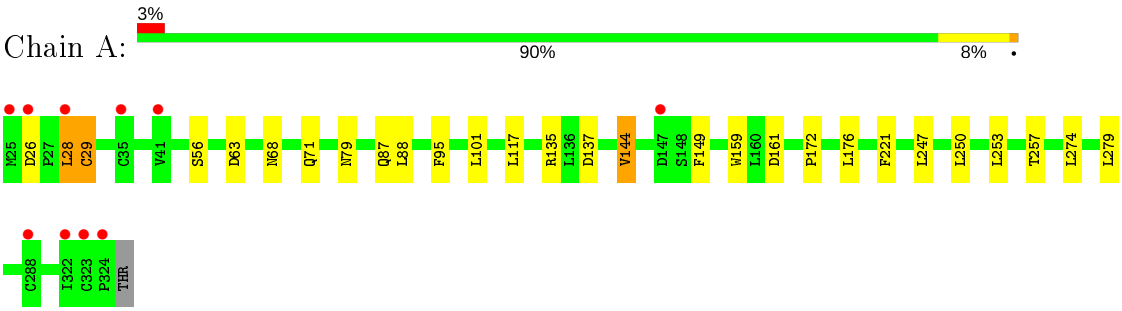
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	E	19	Total O 19 19	0	0
3	C	25	Total O 25 25	0	0

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.

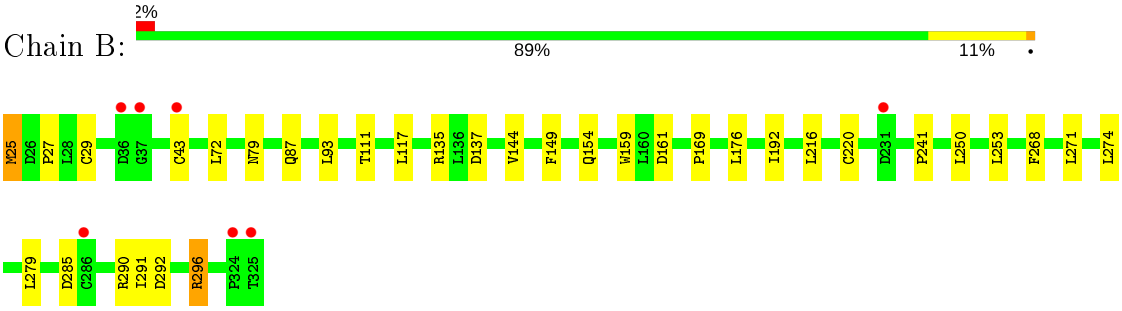
• Molecule 1: Leucine-rich repeat-containing G-protein coupled receptor 4, Variable lymphocyte receptor B

Chain A:



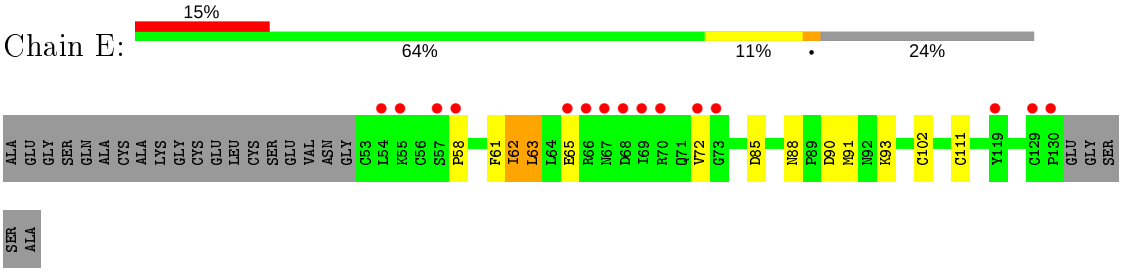
• Molecule 1: Leucine-rich repeat-containing G-protein coupled receptor 4, Variable lymphocyte receptor B

Chain B:



• Molecule 2: R-spondin-1

Chain E:



• Molecule 2: R-spondin-1

Chain C:


ALA
GLU
GLY
SER
GLN
ALA
CYS
ALA
LYS
GLY
CYS
GLU
LEU
CYS
SER
GLU
VAL
ASN
G52
C53
L54
K55
C56
S57
P58
K59
L60
F61
I62
L63
R66
N67
D68
I69
R70
Q71
V72
P77
F84
D85
N92
C105
C129
P130
GLU
GLY
SER
SER
ALA

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	44.87Å 137.91Å 82.56Å 90.00° 100.13° 90.00°	Depositor
Resolution (Å)	50.00 – 2.25 37.19 – 2.25	Depositor EDS
% Data completeness (in resolution range)	98.5 (50.00-2.25) 98.6 (37.19-2.25)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
$< I/\sigma(I) >$ [1]	9.61 (at 2.24Å)	Xtriage
Refinement program	REFMAC 5.0	Depositor
R, R_{free}	0.213 , 0.243 0.224 , 0.254	Depositor DCC
R_{free} test set	2319 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	22.5	Xtriage
Anisotropy	0.298	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 41.7	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	6122	wwPDB-VP
Average B, all atoms (Å^2)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.90% 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, 0.333 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	0.45	0/2366	0.58	0/3218
1	B	0.43	0/2373	0.57	0/3228
2	C	0.44	0/623	0.58	0/838
2	E	0.40	0/623	0.61	0/837
All	All	0.44	0/5985	0.58	0/8121

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

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	2319	0	2320	12	0
1	B	2326	0	2327	19	0
2	C	607	0	588	8	0
2	E	607	0	598	7	0
3	A	106	0	0	2	0
3	B	113	0	0	1	0
3	C	25	0	0	0	0
3	E	19	0	0	0	0
All	All	6122	0	5833	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:B:144:VAL:HG11	1:B:169:PRO:HB3	1.34	1.05
2:E:102:CYS:HG	2:E:111:CYS:HG	1.02	0.93
1:B:144:VAL:CG1	1:B:169:PRO:HB3	2.06	0.86
1:B:144:VAL:HG11	1:B:169:PRO:CB	2.11	0.79
1:A:26:ASP:HB3	1:A:29:CYS:HB2	1.67	0.75
2:C:60:LEU:HD22	2:C:77:PRO:HA	1.77	0.67
1:B:216:LEU:HD12	1:B:241:PRO:HB3	1.79	0.63
1:B:135:ARG:HG2	1:B:159:TRP:CE3	2.35	0.62
1:A:135:ARG:HG2	1:A:159:TRP:CE3	2.36	0.61
2:C:61:PHE:CE1	2:C:85:ASP:HB3	2.36	0.60
2:C:61:PHE:CZ	2:C:85:ASP:HB3	2.38	0.59
1:A:28:LEU:HB2	1:A:56:SER:HB2	1.85	0.58
1:B:149:PHE:HB3	1:B:176:LEU:HD21	1.86	0.58
2:C:58:PRO:O	2:C:59:LYS:HB3	2.03	0.58
2:C:84:PHE:HB3	2:C:105:CYS:SG	2.45	0.57
1:B:296:ARG:HH11	1:B:296:ARG:HB3	1.71	0.55
1:B:79:ASN:HB3	3:B:754:HOH:O	2.07	0.55
2:E:88:ASN:HD22	2:E:91:MET:H	1.54	0.54
1:B:25:MET:HG2	1:B:27:PRO:HD3	1.91	0.52
1:B:135:ARG:HG2	1:B:159:TRP:CD2	2.46	0.51
1:A:149:PHE:HB3	1:A:176:LEU:HD21	1.95	0.49
2:E:62:ILE:HG21	2:E:91:MET:HE3	1.96	0.48
1:B:137:ASP:HB3	1:B:161:ASP:OD1	2.14	0.48
1:B:192:ILE:HG22	1:B:220:CYS:HB2	1.97	0.46
1:B:291:ILE:O	1:B:291:ILE:HG13	2.15	0.46
1:A:137:ASP:HB3	1:A:161:ASP:OD1	2.16	0.46
1:A:71:GLN:HG2	1:A:95:PHE:HB3	1.97	0.46
1:A:79:ASN:HB3	3:A:768:HOH:O	2.16	0.45
1:A:221:PHE:HB3	1:A:247:LEU:HD21	1.99	0.45
1:B:285:ASP:OD2	1:B:290:ARG:NH1	2.50	0.44
2:E:62:ILE:HD13	2:E:63:LEU:N	2.31	0.44
1:A:135:ARG:HG2	1:A:159:TRP:CD2	2.52	0.44
2:E:88:ASN:ND2	2:E:90:ASP:H	2.16	0.44
2:C:129:CYS:HA	2:C:130:PRO:HD3	1.81	0.44
1:A:63:ASP:HA	1:A:87:GLN:HB2	2.00	0.43
1:A:68:ASN:HB2	3:A:763:HOH:O	2.17	0.43
1:B:72:LEU:HG	1:B:93:LEU:HD11	2.00	0.43
1:B:87:GLN:HA	1:B:111:THR:OG1	2.18	0.43
1:B:292:ASP:O	1:B:296:ARG:HG3	2.19	0.42
2:E:62:ILE:HG21	2:E:91:MET:CE	2.49	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:69:ILE:O	2:C:69:ILE:HG22	2.20	0.42
1:A:144:VAL:HG22	1:A:172:PRO:HG2	2.02	0.42
1:B:268:PHE:HA	1:B:271:LEU:HD12	2.02	0.41
2:E:61:PHE:CE1	2:E:85:ASP:HB3	2.56	0.41
2:C:61:PHE:CD1	2:C:92:ASN:HB3	2.56	0.41
1:B:25:MET:SD	1:B:25:MET:N	2.94	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	298/301 (99%)	280 (94%)	18 (6%)	0	100 100
1	B	299/301 (99%)	286 (96%)	13 (4%)	0	100 100
2	C	77/102 (76%)	73 (95%)	2 (3%)	2 (3%)	5 2
2	E	76/102 (74%)	72 (95%)	3 (4%)	1 (1%)	12 8
All	All	750/806 (93%)	711 (95%)	36 (5%)	3 (0%)	34 37

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	C	59	LYS
2	E	58	PRO
2	C	58	PRO

5.3.2 Protein sidechains

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	267/268 (100%)	256 (96%)	11 (4%)	30	36
1	B	268/268 (100%)	258 (96%)	10 (4%)	34	40
2	C	68/87 (78%)	64 (94%)	4 (6%)	19	19
2	E	69/87 (79%)	64 (93%)	5 (7%)	14	12
All	All	672/710 (95%)	642 (96%)	30 (4%)	27	31

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	28	LEU
1	A	29	CYS
1	A	88	LEU
1	A	101	LEU
1	A	117	LEU
1	A	144	VAL
1	A	250	LEU
1	A	253	LEU
1	A	257	THR
1	A	274	LEU
1	A	279	LEU
1	B	25	MET
1	B	29	CYS
1	B	43	CYS
1	B	117	LEU
1	B	154	GLN
1	B	250	LEU
1	B	253	LEU
1	B	274	LEU
1	B	279	LEU
1	B	296	ARG
2	E	62	ILE
2	E	63	LEU
2	E	65	GLU
2	E	72	VAL
2	E	93	LYS
2	C	53	CYS
2	C	59	LYS
2	C	63	LEU
2	C	70	ARG

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

Mol	Chain	Res	Type
1	B	154	GLN
1	B	219	HIS
1	B	236	ASN
1	B	299	ASN
2	E	88	ASN
2	C	71	GLN

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

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

5.5 Carbohydrates

There are no carbohydrates in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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^{th} 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	300/301 (99%)	0.37	10 (3%) 46 48	9, 23, 48, 85	0
1	B	301/301 (100%)	0.33	7 (2%) 60 63	11, 26, 43, 68	0
2	C	79/102 (77%)	0.96	10 (12%) 3 3	16, 32, 61, 76	0
2	E	78/102 (76%)	1.21	15 (19%) 1 1	15, 39, 76, 110	0
All	All	758/806 (94%)	0.50	42 (5%) 25 27	9, 26, 55, 110	0

All (42) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	E	67	ASN	8.2
2	C	67	ASN	7.7
2	E	68	ASP	5.9
1	B	325	THR	5.8
2	E	69	ILE	5.8
2	E	58	PRO	4.8
1	B	37	GLY	4.8
1	A	25	MET	4.6
2	E	66	ARG	4.4
1	A	288	CYS	4.4
1	B	324	PRO	4.3
2	C	58	PRO	4.2
2	E	129	CYS	4.0
1	A	322	ILE	4.0
1	B	43	CYS	3.8
2	C	69	ILE	3.7
1	B	36	ASP	3.3
2	C	68	ASP	3.2
2	E	72	VAL	3.2
2	E	57	SER	3.2
1	A	35	CYS	3.2

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
2	E	65	GLU	3.0
2	E	54	LEU	2.9
2	C	54	LEU	2.9
1	A	323	CYS	2.8
2	C	53	CYS	2.8
2	E	70	ARG	2.8
2	E	119	TYR	2.8
2	C	66	ARG	2.6
2	C	56	CYS	2.5
1	A	324	PRO	2.4
2	C	129	CYS	2.4
1	B	286	CYS	2.4
2	C	72	VAL	2.4
2	E	73	GLY	2.2
1	A	28	LEU	2.1
2	E	55	LYS	2.1
1	A	147	ASP	2.1
1	A	26	ASP	2.1
1	A	41	VAL	2.1
2	E	130	PRO	2.1
1	B	231	ASP	2.0

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.