



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 10:24 AM UTC

PDB ID : 3X1O / pdb_00003x1o
Title : Crystal structure of the ROQ domain of human Roquin
Authors : Ose, T.; Verma, A.; Cockburn, J.B.; Berrow, N.S.; Alderton, D.; Stuart, D.; Owens, R.J.; Jones, E.Y.
Deposited on : 2014-11-26
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

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>.

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

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (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

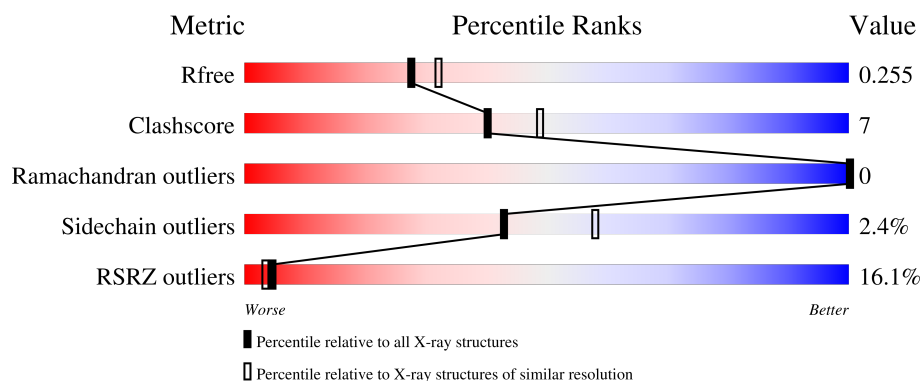
1 Overall quality at a glance

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 ≥ 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	208	2% 62% 9% 28%
1	B	208	21% 59% 12% 28%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2519 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 Roquin-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	149	Total	C	N	O	S	0	0	0
			1179	745	213	215	6			
1	B	150	Total	C	N	O	S	0	0	0
			1153	732	203	212	6			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	144	MET	-	expression tag	UNP Q5TC82
A	345	LYS	-	expression tag	UNP Q5TC82
A	346	HIS	-	expression tag	UNP Q5TC82
A	347	HIS	-	expression tag	UNP Q5TC82
A	348	HIS	-	expression tag	UNP Q5TC82
A	349	HIS	-	expression tag	UNP Q5TC82
A	350	HIS	-	expression tag	UNP Q5TC82
A	351	HIS	-	expression tag	UNP Q5TC82
B	144	MET	-	expression tag	UNP Q5TC82
B	345	LYS	-	expression tag	UNP Q5TC82
B	346	HIS	-	expression tag	UNP Q5TC82
B	347	HIS	-	expression tag	UNP Q5TC82
B	348	HIS	-	expression tag	UNP Q5TC82
B	349	HIS	-	expression tag	UNP Q5TC82
B	350	HIS	-	expression tag	UNP Q5TC82
B	351	HIS	-	expression tag	UNP Q5TC82

- Molecule 2 is IODIDE ION (CCD ID: IOD) (formula: I).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	13	Total	I	0	0
			13	13		
2	B	8	Total	I	0	0
			8	8		

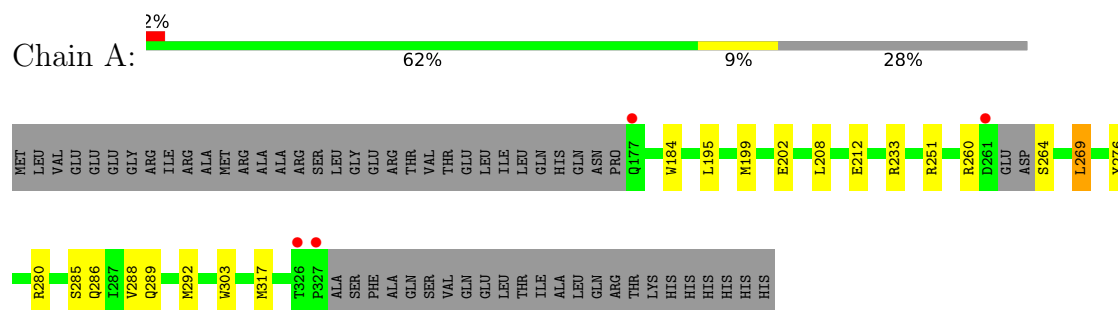
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	115	Total 115	O 115	0	0
3	B	51	Total 51	O 51	0	0

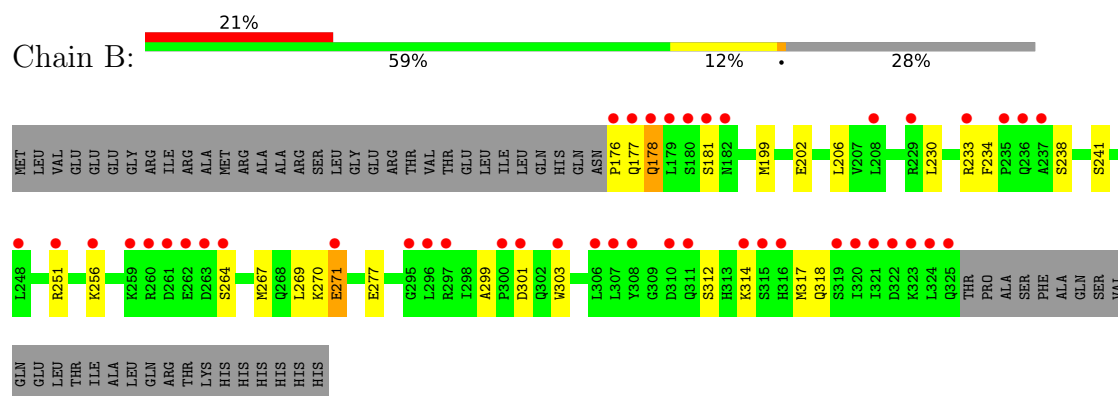
3 Residue-property plots [i](#)

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: Roquin-1



• Molecule 1: Roquin-1



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	55.00Å 78.32Å 184.07Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	28.50 – 2.20 28.50 – 2.20	Depositor EDS
% Data completeness (in resolution range)	97.3 (28.50-2.20) 97.3 (28.50-2.20)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.75 (at 2.20Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.9_1692)	Depositor
R, R_{free}	0.217 , 0.252 0.221 , 0.255	Depositor DCC
R_{free} test set	1216 reflections (5.90%)	wwPDB-VP
Wilson B-factor (Å ²)	29.5	Xtriage
Anisotropy	0.012	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 42.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	2519	wwPDB-VP
Average B, all atoms (Å ²)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.04% of the height of the origin peak. No significant pseudotranslation is detected.*

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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: IOD

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	0.40	0/1198	0.71	0/1614
1	B	0.36	0/1173	0.84	4/1586 (0.3%)
All	All	0.38	0/2371	0.78	4/3200 (0.1%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	299	ALA	CA-C-N	5.69	125.37	119.56
1	B	299	ALA	C-N-CA	5.69	125.37	119.56
1	B	181	SER	CA-C-N	-5.18	112.55	121.66
1	B	181	SER	C-N-CA	-5.18	112.55	121.66

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	1179	0	1198	15	0
1	B	1153	0	1145	16	0
2	A	13	0	0	1	0
2	B	8	0	0	1	0
3	A	115	0	0	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	51	0	0	4	0
All	All	2519	0	2343	31	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 7.

All (31) 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:314:LYS:O	3:B:546:HOH:O	1.97	0.82
1:B:202:GLU:HG3	1:B:233:ARG:HH12	1.45	0.81
1:A:289:GLN:HA	1:A:292:MET:HE2	1.63	0.80
1:A:233:ARG:NH2	3:A:601:HOH:O	2.25	0.68
1:A:212:GLU:OE1	3:A:571:HOH:O	2.10	0.68
1:B:303:TRP:HB3	1:B:317:MET:HE2	1.89	0.54
1:B:178:GLN:H	1:B:178:GLN:CD	2.16	0.53
1:B:267:MET:HE3	2:B:401:IOD:I	2.79	0.53
1:A:303:TRP:HB3	1:A:317:MET:HG3	1.91	0.52
1:A:184:TRP:HB3	2:A:405:IOD:I	2.83	0.49
1:A:251:ARG:NH1	1:A:286:GLN:OE1	2.42	0.48
1:B:271:GLU:H	1:B:271:GLU:CD	2.20	0.48
1:B:301:ASP:OD2	3:B:538:HOH:O	2.20	0.47
1:A:260:ARG:NE	1:A:264:SER:O	2.42	0.47
1:B:318:GLN:N	3:B:546:HOH:O	2.47	0.47
1:A:288:VAL:O	1:A:292:MET:HG3	2.15	0.47
1:A:195:LEU:HD13	1:A:199:MET:HE2	1.96	0.47
1:A:286:GLN:NE2	1:A:289:GLN:HE21	2.13	0.46
1:B:256:LYS:HG2	1:B:270:LYS:HG2	1.98	0.45
1:B:206:LEU:HD12	1:B:230:LEU:HD13	1.99	0.44
1:B:202:GLU:HG3	1:B:233:ARG:NH1	2.25	0.44
1:A:208:LEU:HD11	1:A:276:TYR:N	2.33	0.43
1:A:202:GLU:HB2	3:A:599:HOH:O	2.18	0.43
1:A:269:LEU:HD12	1:A:269:LEU:HA	1.95	0.42
1:A:285:SER:O	1:A:289:GLN:HG3	2.20	0.42
1:B:312:SER:HB2	3:B:540:HOH:O	2.19	0.42
1:B:269:LEU:HD12	1:B:269:LEU:HA	1.93	0.41
1:B:176:PRO:HB2	1:B:177:GLN:H	1.50	0.41
1:B:199:MET:HG3	1:B:234:PHE:CG	2.56	0.41
1:A:280:ARG:HA	1:A:280:ARG:HD2	1.93	0.40
1:B:238:SER:H	1:B:241:SER:HB3	1.87	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	145/208 (70%)	143 (99%)	2 (1%)	0	100	100
1	B	148/208 (71%)	142 (96%)	6 (4%)	0	100	100
All	All	293/416 (70%)	285 (97%)	8 (3%)	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	128/181 (71%)	127 (99%)	1 (1%)	73	85
1	B	121/181 (67%)	116 (96%)	5 (4%)	27	37
All	All	249/362 (69%)	243 (98%)	6 (2%)	43	58

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	269	LEU
1	B	178	GLN
1	B	251	ARG
1	B	264	SER
1	B	271	GLU

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Mol	Chain	Res	Type
1	B	277	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	289	GLN
1	A	318	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](#)

Of 21 ligands modelled in this entry, 21 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 ⓘ

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, 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	149/208 (71%)	0.02	4 (2%) 56 53	16, 25, 48, 81	0
1	B	150/208 (72%)	1.47	44 (29%) 1 1	28, 49, 75, 98	0
All	All	299/416 (71%)	0.75	48 (16%) 4 3	16, 36, 71, 98	0

All (48) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	263	ASP	6.1
1	B	176	PRO	5.2
1	B	297	ARG	4.5
1	A	261	ASP	4.0
1	B	321	ILE	4.0
1	B	237	ALA	3.9
1	B	259	LYS	3.9
1	B	262	GLU	3.9
1	B	314	LYS	3.7
1	A	326	THR	3.7
1	B	236	GLN	3.6
1	B	300	PRO	3.6
1	B	322	ASP	3.6
1	A	327	PRO	3.5
1	B	310	ASP	3.4
1	B	179	LEU	3.2
1	B	261	ASP	3.1
1	B	324	LEU	3.1
1	B	182	ASN	3.0
1	A	177	GLN	3.0
1	B	264	SER	3.0
1	B	325	GLN	2.9
1	B	260	ARG	2.8
1	B	229	ARG	2.8

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Mol	Chain	Res	Type	RSRZ
1	B	177	GLN	2.7
1	B	180	SER	2.7
1	B	319	SER	2.7
1	B	181	SER	2.6
1	B	316	HIS	2.6
1	B	233	ARG	2.6
1	B	308	TYR	2.6
1	B	235	PRO	2.5
1	B	311	GLN	2.5
1	B	271	GLU	2.5
1	B	306	LEU	2.5
1	B	320	ILE	2.3
1	B	315	SER	2.3
1	B	251	ARG	2.3
1	B	301	ASP	2.3
1	B	256	LYS	2.3
1	B	307	LEU	2.2
1	B	303	TRP	2.2
1	B	178	GLN	2.1
1	B	296	LEU	2.1
1	B	208	LEU	2.0
1	B	295	GLY	2.0
1	B	323	LYS	2.0
1	B	248	LEU	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 oligosaccharides 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, 95th 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($\text{\AA}^2$)	Q<0.9
2	IOD	A	411	1/1	0.59	0.34	207,207,207,207	0
2	IOD	B	403	1/1	0.85	0.23	120,120,120,120	0
2	IOD	B	405	1/1	0.87	0.13	107,107,107,107	0
2	IOD	B	404	1/1	0.88	0.24	133,133,133,133	0
2	IOD	B	407	1/1	0.89	0.23	116,116,116,116	0
2	IOD	B	402	1/1	0.90	0.15	92,92,92,92	0
2	IOD	B	406	1/1	0.91	0.13	118,118,118,118	0
2	IOD	A	409	1/1	0.92	0.22	106,106,106,106	0
2	IOD	A	412	1/1	0.92	0.32	106,106,106,106	0
2	IOD	A	406	1/1	0.94	0.14	81,81,81,81	0
2	IOD	A	405	1/1	0.94	0.12	52,52,52,52	0
2	IOD	A	404	1/1	0.95	0.11	73,73,73,73	0
2	IOD	A	408	1/1	0.95	0.11	62,62,62,62	0
2	IOD	A	413	1/1	0.95	0.21	100,100,100,100	0
2	IOD	B	401	1/1	0.95	0.18	118,118,118,118	0
2	IOD	A	402	1/1	0.95	0.07	71,71,71,71	0
2	IOD	A	407	1/1	0.98	0.09	56,56,56,56	0
2	IOD	A	410	1/1	0.98	0.15	74,74,74,74	0
2	IOD	B	408	1/1	0.98	0.13	95,95,95,95	0
2	IOD	A	403	1/1	0.99	0.10	56,56,56,56	0
2	IOD	A	401	1/1	1.00	0.04	37,37,37,37	0

6.5 Other polymers

There are no such residues in this entry.