



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 5, 2026 – 04:47 pm GMT

PDB ID : 9RFA / pdb\_00009rfa  
Title : Apo structure of glxR  
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Deposited on : 2025-06-04  
Resolution : 2.07 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 : 4-5-2 with Phenix2.0  
Xtriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
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) : 2.47

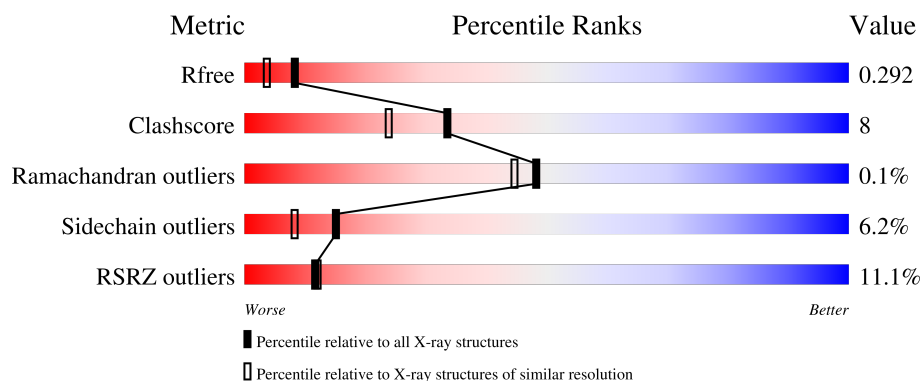
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.07 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))
$R_{free}$	164625	3436 (2.08-2.04)
Clashscore	180529	3661 (2.08-2.04)
Ramachandran outliers	177936	3649 (2.08-2.04)
Sidechain outliers	177891	3649 (2.08-2.04)
RSRZ outliers	164620	3436 (2.08-2.04)

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	312	<div> <div>7%</div> <div>81%</div> <div>12%</div> <div>• 5%</div> </div>
1	B	312	<div> <div>21%</div> <div>70%</div> <div>21%</div> <div>• 5%</div> </div>
1	C	312	<div> <div>7%</div> <div>80%</div> <div>15%</div> <div>5%</div> </div>
1	D	312	<div> <div>6%</div> <div>79%</div> <div>13%</div> <div>• 5%</div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 8736 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 Probable oxidoreductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	296	Total	C	N	O	S	0	0	0
			2171	1364	387	408	12			
1	B	296	Total	C	N	O	S	0	0	0
			2170	1363	385	410	12			
1	C	296	Total	C	N	O	S	0	0	0
			2170	1363	385	410	12			
1	D	297	Total	C	N	O	S	0	0	0
			2180	1369	389	410	12			

There are 64 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	initiating methionine	UNP Q9I3L2
A	2	GLY	-	expression tag	UNP Q9I3L2
A	3	HIS	-	expression tag	UNP Q9I3L2
A	4	HIS	-	expression tag	UNP Q9I3L2
A	5	HIS	-	expression tag	UNP Q9I3L2
A	6	HIS	-	expression tag	UNP Q9I3L2
A	7	HIS	-	expression tag	UNP Q9I3L2
A	8	HIS	-	expression tag	UNP Q9I3L2
A	9	ALA	-	expression tag	UNP Q9I3L2
A	10	GLU	-	expression tag	UNP Q9I3L2
A	11	ASN	-	expression tag	UNP Q9I3L2
A	12	LEU	-	expression tag	UNP Q9I3L2
A	13	TYR	-	expression tag	UNP Q9I3L2
A	14	PHE	-	expression tag	UNP Q9I3L2
A	15	GLN	-	expression tag	UNP Q9I3L2
A	16	HIS	-	expression tag	UNP Q9I3L2
B	1	MET	-	initiating methionine	UNP Q9I3L2
B	2	GLY	-	expression tag	UNP Q9I3L2
B	3	HIS	-	expression tag	UNP Q9I3L2
B	4	HIS	-	expression tag	UNP Q9I3L2
B	5	HIS	-	expression tag	UNP Q9I3L2

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Chain	Residue	Modelled	Actual	Comment	Reference
B	6	HIS	-	expression tag	UNP Q9I3L2
B	7	HIS	-	expression tag	UNP Q9I3L2
B	8	HIS	-	expression tag	UNP Q9I3L2
B	9	ALA	-	expression tag	UNP Q9I3L2
B	10	GLU	-	expression tag	UNP Q9I3L2
B	11	ASN	-	expression tag	UNP Q9I3L2
B	12	LEU	-	expression tag	UNP Q9I3L2
B	13	TYR	-	expression tag	UNP Q9I3L2
B	14	PHE	-	expression tag	UNP Q9I3L2
B	15	GLN	-	expression tag	UNP Q9I3L2
B	16	HIS	-	expression tag	UNP Q9I3L2
C	1	MET	-	initiating methionine	UNP Q9I3L2
C	2	GLY	-	expression tag	UNP Q9I3L2
C	3	HIS	-	expression tag	UNP Q9I3L2
C	4	HIS	-	expression tag	UNP Q9I3L2
C	5	HIS	-	expression tag	UNP Q9I3L2
C	6	HIS	-	expression tag	UNP Q9I3L2
C	7	HIS	-	expression tag	UNP Q9I3L2
C	8	HIS	-	expression tag	UNP Q9I3L2
C	9	ALA	-	expression tag	UNP Q9I3L2
C	10	GLU	-	expression tag	UNP Q9I3L2
C	11	ASN	-	expression tag	UNP Q9I3L2
C	12	LEU	-	expression tag	UNP Q9I3L2
C	13	TYR	-	expression tag	UNP Q9I3L2
C	14	PHE	-	expression tag	UNP Q9I3L2
C	15	GLN	-	expression tag	UNP Q9I3L2
C	16	HIS	-	expression tag	UNP Q9I3L2
D	1	MET	-	initiating methionine	UNP Q9I3L2
D	2	GLY	-	expression tag	UNP Q9I3L2
D	3	HIS	-	expression tag	UNP Q9I3L2
D	4	HIS	-	expression tag	UNP Q9I3L2
D	5	HIS	-	expression tag	UNP Q9I3L2
D	6	HIS	-	expression tag	UNP Q9I3L2
D	7	HIS	-	expression tag	UNP Q9I3L2
D	8	HIS	-	expression tag	UNP Q9I3L2
D	9	ALA	-	expression tag	UNP Q9I3L2
D	10	GLU	-	expression tag	UNP Q9I3L2
D	11	ASN	-	expression tag	UNP Q9I3L2
D	12	LEU	-	expression tag	UNP Q9I3L2
D	13	TYR	-	expression tag	UNP Q9I3L2
D	14	PHE	-	expression tag	UNP Q9I3L2
D	15	GLN	-	expression tag	UNP Q9I3L2

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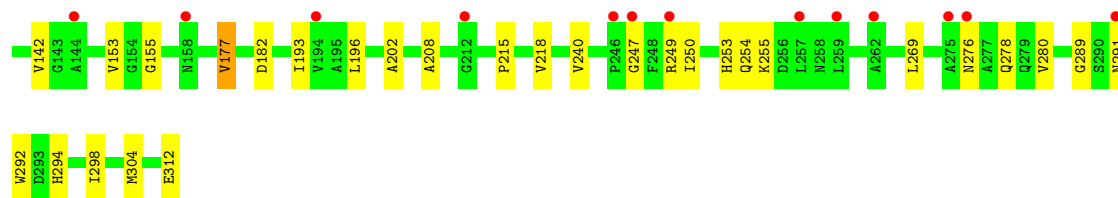
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Chain	Residue	Modelled	Actual	Comment	Reference
D	16	HIS	-	expression tag	UNP Q9I3L2

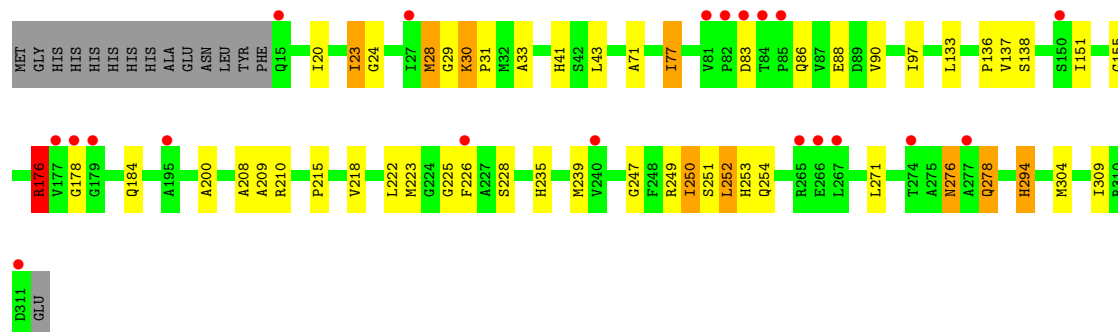
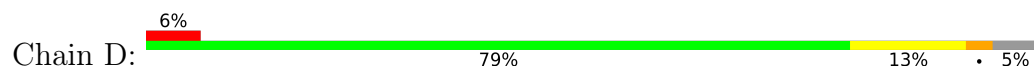
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	4	Total 4	O 4	0	0
2	B	10	Total 10	O 10	0	0
2	C	16	Total 16	O 16	0	0
2	D	15	Total 15	O 15	0	0





- Molecule 1: Probable oxidoreductase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	80.44Å 121.47Å 132.84Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	60.73 – 2.07 60.73 – 2.07	Depositor EDS
% Data completeness (in resolution range)	95.5 (60.73-2.07) 95.5 (60.73-2.07)	Depositor EDS
$R_{merge}$	0.22	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.02 (at 2.07Å)	Xtriage
Refinement program	BUSTER 2.10.4 (10-JUL-2024)	Depositor
R, $R_{free}$	0.270 , 0.315 0.260 , 0.292	Depositor DCC
$R_{free}$ test set	2070 reflections (2.59%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	43.7	Xtriage
Anisotropy	0.378	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 33.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.52$ , $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	8736	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	58.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.77% 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](#)

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	0.78	0/2207	1.14	3/2984 (0.1%)
1	B	0.79	0/2205	1.17	2/2981 (0.1%)
1	C	0.78	0/2205	1.21	3/2981 (0.1%)
1	D	0.80	0/2216	1.13	1/2996 (0.0%)
All	All	0.78	0/8833	1.16	9/11942 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
1	B	0	3
1	D	0	1
All	All	0	5

There are no bond length outliers.

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	247	GLY	N-CA-C	-6.97	96.65	113.18
1	D	247	GLY	N-CA-C	-6.59	97.57	113.18
1	B	246	PRO	N-CA-C	6.29	121.51	111.26
1	C	66	ASN	N-CA-C	6.18	113.79	108.22
1	A	153	VAL	N-CA-C	6.01	116.52	108.11

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	265	ARG	Sidechain

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Mol	Chain	Res	Type	Group
1	B	210	ARG	Sidechain
1	B	310	ARG	Sidechain
1	B	93	ARG	Sidechain
1	D	176	ARG	Sidechain

## 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	2171	0	2190	29	0
1	B	2170	0	2189	49	0
1	C	2170	0	2189	30	0
1	D	2180	0	2198	37	0
2	A	4	0	0	0	0
2	B	10	0	0	0	0
2	C	16	0	0	0	0
2	D	15	0	0	0	0
All	All	8736	0	8766	133	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 8.

The worst 5 of 133 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:22:PHE:HZ	1:B:32:MET:HE3	1.52	0.75
1:A:276:ASN:HD21	1:B:272:PRO:HG2	1.52	0.74
1:B:28:MET:HE3	1:B:144:ALA:HB2	1.68	0.74
1:A:222:LEU:HD22	1:B:190:ASN:HB2	1.71	0.72
1:B:67:PRO:HG2	1:B:96:GLY:HA2	1.71	0.72

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	294/312 (94%)	281 (96%)	12 (4%)	1 (0%)	37	31
1	B	294/312 (94%)	283 (96%)	11 (4%)	0	100	100
1	C	294/312 (94%)	280 (95%)	14 (5%)	0	100	100
1	D	295/312 (95%)	284 (96%)	11 (4%)	0	100	100
All	All	1177/1248 (94%)	1128 (96%)	48 (4%)	1 (0%)	48	45

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	247	GLY

### 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	220/234 (94%)	210 (96%)	10 (4%)	23	17
1	B	220/234 (94%)	198 (90%)	22 (10%)	6	2
1	C	220/234 (94%)	214 (97%)	6 (3%)	40	35
1	D	221/234 (94%)	204 (92%)	17 (8%)	10	4
All	All	881/936 (94%)	826 (94%)	55 (6%)	15	8

5 of 55 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	290	SER
1	C	177	VAL
1	D	309	ILE
1	D	253	HIS
1	B	294	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 25 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	291	ASN
1	C	278	GLN
1	D	303	HIS
1	C	180	ASN
1	C	291	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 oligosaccharides 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, 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	296/312 (94%)	0.85	22 (7%) 22 24	43, 59, 74, 83	0
1	B	296/312 (94%)	1.26	67 (22%) 3 2	38, 63, 99, 105	0
1	C	296/312 (94%)	0.80	23 (7%) 20 22	40, 53, 74, 91	0
1	D	297/312 (95%)	0.67	20 (6%) 25 26	39, 53, 66, 79	0
All	All	1185/1248 (94%)	0.89	132 (11%) 12 12	38, 56, 86, 105	0

The worst 5 of 132 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	247	GLY	4.4
1	A	86	GLN	4.1
1	A	276	ASN	4.0
1	B	36	LEU	3.9
1	A	55	ASP	3.8

### 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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.