



# wwPDB X-ray Structure Validation Summary Report ⓘ

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PDB ID : 2WIS / pdb\_00002wis  
Title : Fluorescent protein KillerRed in the bleached state  
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Deposited on : 2009-05-15  
Resolution : 2.35 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  
Mogul : 2022.3.0, CSD as543be (2022)  
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

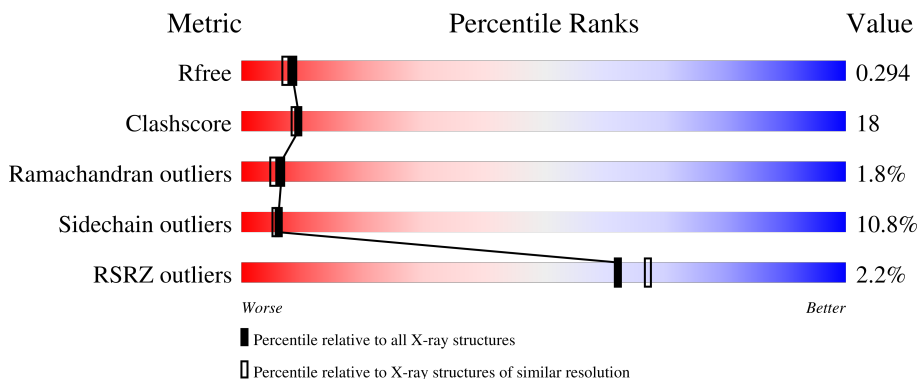
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.35 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	1596 (2.36-2.36)
Clashscore	190562	1663 (2.36-2.36)
Ramachandran outliers	187476	1646 (2.36-2.36)
Sidechain outliers	187428	1646 (2.36-2.36)
RSRZ outliers	180081	1598 (2.36-2.36)

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	257	 3% 57% 26% 12%
1	B	257	 % 53% 30% 7% 11%

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 3800 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 KILLERRED.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	226	1829	1157	316	340	16	0	3	0
1	B	230	1892	1187	326	363	16	0	11	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	65	CRQ	GLN	chromophore	UNP Q2TCH5
A	65	CRQ	TYR	chromophore	UNP Q2TCH5
A	65	CRQ	GLY	chromophore	UNP Q2TCH5
B	65	CRQ	GLN	chromophore	UNP Q2TCH5
B	65	CRQ	TYR	chromophore	UNP Q2TCH5
B	65	CRQ	GLY	chromophore	UNP Q2TCH5

- Molecule 2 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Na		
2	A	1	1	1	0	0
2	B	1	1	1	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	21	21	21	0	0
3	B	56	56	56	0	0



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	71.94Å 73.40Å 75.23Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.81 – 2.35 19.81 – 2.35	Depositor EDS
% Data completeness (in resolution range)	99.9 (19.81-2.35) 99.7 (19.81-2.35)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.53 (at 2.35Å)	Xtriage
Refinement program	REFMAC 5.5.0070	Depositor
R, $R_{free}$	0.222 , 0.302 0.221 , 0.294	Depositor DCC
$R_{free}$ test set	842 reflections (4.92%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	46.9	Xtriage
Anisotropy	0.476	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 39.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.023 for -h,l,k 0.022 for -l,-k,-h 0.018 for k,h,-l 0.002 for k,l,h 0.002 for l,h,k	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	3800	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.62% 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](#)

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

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	0.67	0/1829	0.93	4/2476 (0.2%)
1	B	0.73	1/1919 (0.1%)	0.99	5/2598 (0.2%)
All	All	0.70	1/3748 (0.0%)	0.96	9/5074 (0.2%)

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	B	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	225	VAL	CA-CB	5.18	1.58	1.54

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	201	THR	N-CA-C	7.56	122.67	110.28
1	B	145	ASN	N-CA-C	7.25	119.76	108.96
1	B	74	TYR	CA-C-N	-6.07	112.86	120.51
1	B	74	TYR	C-N-CA	-6.07	112.86	120.51
1	A	53	LEU	CA-C-N	5.46	126.51	120.45

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	100	ASN	Peptide

## 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	1829	0	1720	65	0
1	B	1892	0	1760	71	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	21	0	0	2	0
3	B	56	0	0	12	0
All	All	3800	0	3480	130	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 18.

The worst 5 of 130 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:135[B]:MET:SD	1:A:135[B]:MET:N	2.26	1.06
1:A:65[B]:CRQ:N2	1:A:65[B]:CRQ:HD1	1.75	0.97
1:B:65:CRQ:HD1	1:B:65:CRQ:N2	1.85	0.88
1:B:124[B]:ASN:OD1	1:B:126:ASP:OD2	1.96	0.84
1:A:73:ARG:CG	1:A:73:ARG:HH11	1.92	0.82

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	223/257 (87%)	207 (93%)	14 (6%)	2 (1%)	14	14
1	B	236/257 (92%)	217 (92%)	13 (6%)	6 (2%)	4	3
All	All	459/514 (89%)	424 (92%)	27 (6%)	8 (2%)	6	6

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	206	ASP
1	B	231	ALA
1	B	232	ILE
1	B	230	SER
1	A	114	ASP

### 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	197/220 (90%)	175 (89%)	22 (11%)	6	5
1	B	206/220 (94%)	185 (90%)	21 (10%)	7	6
All	All	403/440 (92%)	360 (89%)	43 (11%)	6	6

5 of 43 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	78	ILE
1	B	190[A]	GLU
1	B	90	LEU
1	B	139	LEU
1	B	197	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	25	GLN
1	B	39	HIS
1	B	176	HIS
1	B	62	HIS
1	A	108	HIS

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

3 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
1	CRQ	A	65[B]	1	25,25,26	4.34	5 (20%)	28,34,36	5.03	7 (25%)
1	CRQ	A	65[A]	1	25,25,26	4.20	5 (20%)	28,34,36	4.72	6 (21%)
1	CRQ	B	65	1	25,25,26	4.63	6 (24%)	28,34,36	4.67	7 (25%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	CRQ	A	65[B]	1	-	6/10/32/33	0/2/2/2
1	CRQ	A	65[A]	1	-	8/10/32/33	0/2/2/2
1	CRQ	B	65	1	-	5/10/32/33	0/2/2/2

The worst 5 of 16 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	65	CRQ	CB2-CA2	18.31	1.52	1.35
1	A	65[B]	CRQ	CB2-CA2	16.90	1.51	1.35
1	A	65[A]	CRQ	CB2-CA2	15.98	1.50	1.35
1	B	65	CRQ	O2-C2	12.46	1.48	1.23
1	A	65[B]	CRQ	O2-C2	12.33	1.48	1.23

The worst 5 of 20 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	65[B]	CRQ	CG2-CB2-CA2	-17.70	108.82	129.87
1	A	65[A]	CRQ	CG2-CB2-CA2	-16.48	110.27	129.87
1	B	65	CRQ	CG2-CB2-CA2	-15.20	111.79	129.87
1	A	65[B]	CRQ	O2-C2-CA2	-12.02	123.35	131.02
1	B	65	CRQ	O2-C2-CA2	-10.88	124.07	131.02

There are no chirality outliers.

5 of 19 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	65[A]	CRQ	C1-CA1-CB1-CG1
1	A	65[A]	CRQ	C3-CA3-N3-C1
1	A	65[A]	CRQ	C3-CA3-N3-C2
1	A	65[A]	CRQ	N2-CA2-CB2-CG2
1	A	65[A]	CRQ	C2-CA2-CB2-CG2

There are no ring outliers.

3 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	65[B]	CRQ	6	0
1	A	65[A]	CRQ	1	0
1	B	65	CRQ	3	0

## 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 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 [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	225/257 (87%)	0.37	7 (3%) 51 58	23, 59, 77, 87	2 (0%)
1	B	229/257 (89%)	0.14	3 (1%) 75 79	15, 43, 70, 79	12 (5%)
All	All	454/514 (88%)	0.25	10 (2%) 62 67	15, 49, 75, 87	14 (3%)

The worst 5 of 10 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	9	GLN	3.2
1	A	135[A]	MET	3.0
1	A	206	ASP	2.5
1	B	188	ALA	2.3
1	A	208	SER	2.3

### 6.2 Non-standard residues in protein, DNA, RNA chains [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, 95<sup>th</sup> 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(Å <sup>2</sup> )	Q<0.9
1	CRQ	A	65[A]	24/25	0.75	0.15	55,59,62,62	24
1	CRQ	A	65[B]	24/25	0.75	0.15	56,59,63,64	24
1	CRQ	B	65	24/25	0.84	0.10	41,47,54,56	0

### 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, 95<sup>th</sup> 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	NA	A	1230	1/1	0.77	0.17	64,64,64,64	0
2	NA	B	1234	1/1	0.82	0.17	62,62,62,62	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.