wwPDB X-ray Structure Validation Summary Report (i)

Nov 5, 2023 – 09:39 AM EST

PDB ID	:	2IE2
Title	:	The 1.7 A crystal structure of Dronpa: a photoswitchable green fluorescent protein
Authors	:	Rossjohn, J.; Wilmann, P.G.
Deposited on	:	2006-09-16
Resolution	:	1.70 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) 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 (i)) were used in the production of this report:

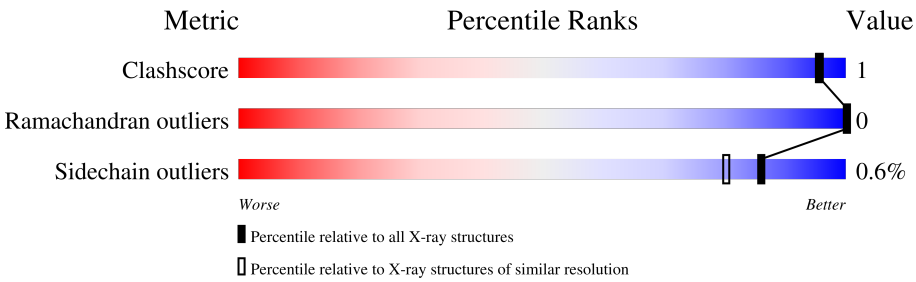
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 1.70 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))
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)

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 <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	222	95%
1	B	222	93%
1	C	222	91% 5%
1	D	222	93%
1	E	222	92% 5%
1	F	222	92%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 11034 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 Fluorescent protein Dronpa.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	214	1718	1098	290	320	10	0	0	0
1	B	214	1711	1094	289	318	10	0	0	0
1	C	213	1709	1092	288	319	10	0	0	0
1	D	214	1718	1098	290	320	10	0	0	0
1	E	215	1728	1105	292	321	10	0	0	0
1	F	214	1711	1095	290	316	10	0	0	0

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	62	GYC	CYS	chromophore	UNP Q5TLG6
A	62	GYC	TYR	chromophore	UNP Q5TLG6
A	62	GYC	GLY	chromophore	UNP Q5TLG6
B	62	GYC	CYS	chromophore	UNP Q5TLG6
B	62	GYC	TYR	chromophore	UNP Q5TLG6
B	62	GYC	GLY	chromophore	UNP Q5TLG6
C	62	GYC	CYS	chromophore	UNP Q5TLG6
C	62	GYC	TYR	chromophore	UNP Q5TLG6
C	62	GYC	GLY	chromophore	UNP Q5TLG6
D	62	GYC	CYS	chromophore	UNP Q5TLG6
D	62	GYC	TYR	chromophore	UNP Q5TLG6
D	62	GYC	GLY	chromophore	UNP Q5TLG6
E	62	GYC	CYS	chromophore	UNP Q5TLG6
E	62	GYC	TYR	chromophore	UNP Q5TLG6
E	62	GYC	GLY	chromophore	UNP Q5TLG6
F	62	GYC	CYS	chromophore	UNP Q5TLG6
F	62	GYC	TYR	chromophore	UNP Q5TLG6

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Chain	Residue	Modelled	Actual	Comment	Reference
F	62	GYC	GLY	chromophore	UNP Q5TLG6

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	113	113	113	0	0
			Total	O		
2	B	141	141	141	0	0
			Total	O		
2	C	115	115	115	0	0
			Total	O		
2	D	130	130	130	0	0
			Total	O		
2	E	144	144	144	0	0
			Total	O		
2	F	96	96	96	0	0

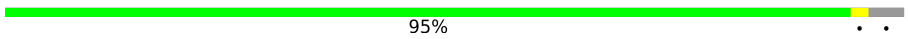
3 Residue-property plots (i)

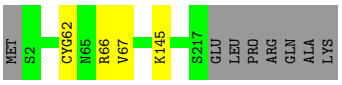
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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. 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.

Note EDS was not executed.

• Molecule 1: Fluorescent protein Dronpa

Chain A:





• Molecule 1: Fluorescent protein Dronpa

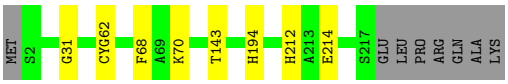
Chain B:

• Molecule 1: Fluorescent protein Dronpa

Chain C:

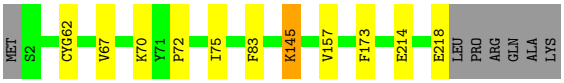
• Molecule 1: Fluorescent protein Dronpa

Chain D:



• Molecule 1: Fluorescent protein Dronpa

Chain E:



• Molecule 1: Fluorescent protein Dronpa

Chain F: 92%

MET
S2
CYG62
V67
F83
T136
T143
E144
K145
L161
K198
H210
S217
GLU
LEU
PRO
ARG
GLN
ALA
LYS

4 Data and refinement statistics (i)

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α, β, γ	103.14Å 175.50Å 67.44Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	89.09 – 1.70	Depositor
% Data completeness (in resolution range)	96.3 (89.09-1.70)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.198 , 0.221	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	11034	wwPDB-VP
Average B, all atoms (Å^2)	19.0	wwPDB-VP

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: GYC

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	0.32	0/1742	0.49	0/2353
1	B	0.32	0/1735	0.50	0/2345
1	C	0.32	0/1733	0.48	0/2342
1	D	0.32	0/1742	0.50	0/2353
1	E	0.32	0/1752	0.50	0/2365
1	F	0.32	0/1735	0.49	0/2344
All	All	0.32	0/10439	0.49	0/14102

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	1718	0	1634	0	0
1	B	1711	0	1621	4	0
1	C	1709	0	1621	5	0
1	D	1718	0	1634	5	0
1	E	1728	0	1649	5	0
1	F	1711	0	1628	6	0
2	A	113	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	141	0	0	0	0
2	C	115	0	0	0	0
2	D	130	0	0	0	0
2	E	144	0	0	0	0
2	F	96	0	0	0	0
All	All	11034	0	9787	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 1.

The worst 5 of 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:D:194:HIS:HB3	1:D:212:HIS:CE1	2.41	0.56
1:C:70:LYS:HB3	1:C:214:GLU:HG2	1.87	0.55
1:F:67:VAL:HG11	1:F:83:PHE:CE1	2.44	0.52
1:B:148:VAL:HG21	1:B:185:LEU:HB3	1.91	0.52
1:B:67:VAL:HG11	1:B:83:PHE:CE1	2.45	0.52

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	209/222 (94%)	207 (99%)	2 (1%)	0	100	100
1	B	209/222 (94%)	208 (100%)	1 (0%)	0	100	100
1	C	208/222 (94%)	207 (100%)	1 (0%)	0	100	100
1	D	209/222 (94%)	207 (99%)	2 (1%)	0	100	100
1	E	210/222 (95%)	208 (99%)	2 (1%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	F	209/222 (94%)	208 (100%)	1 (0%)	0	100	100
All	All	1254/1332 (94%)	1245 (99%)	9 (1%)	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	181/191 (95%)	178 (98%)	3 (2%)	60	46
1	B	179/191 (94%)	178 (99%)	1 (1%)	86	80
1	C	180/191 (94%)	179 (99%)	1 (1%)	86	80
1	D	181/191 (95%)	181 (100%)	0	100	100
1	E	182/191 (95%)	180 (99%)	2 (1%)	73	63
1	F	179/191 (94%)	179 (100%)	0	100	100
All	All	1082/1146 (94%)	1075 (99%)	7 (1%)	86	80

5 of 7 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	66	ARG
1	C	67	VAL
1	E	218	GLU
1	E	145	LYS
1	A	145	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 15 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	194	HIS
1	F	194	HIS
1	D	212	HIS

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Mol	Chain	Res	Type
1	F	216	HIS
1	E	194	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)

6 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	GYC	D	62	1	22,22,23	3.53	10 (45%)	26,30,32	3.45	6 (23%)
1	GYC	B	62	1	22,22,23	3.53	9 (40%)	26,30,32	3.50	7 (26%)
1	GYC	E	62	1	22,22,23	3.55	10 (45%)	26,30,32	3.61	8 (30%)
1	GYC	F	62	1	22,22,23	3.58	10 (45%)	26,30,32	3.43	6 (23%)
1	GYC	A	62	1	22,22,23	3.53	10 (45%)	26,30,32	3.55	8 (30%)
1	GYC	C	62	1	22,22,23	3.54	9 (40%)	26,30,32	3.59	9 (34%)

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	GYC	D	62	1	-	2/9/29/30	0/2/2/2
1	GYC	B	62	1	-	2/9/29/30	0/2/2/2
1	GYC	E	62	1	-	2/9/29/30	0/2/2/2
1	GYC	F	62	1	-	3/9/29/30	0/2/2/2
1	GYC	A	62	1	-	2/9/29/30	0/2/2/2

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	GYC	C	62	1	-	2/9/29/30	0/2/2/2

The worst 5 of 58 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	F	62	GYC	CB1-SG1	-11.72	1.56	1.81
1	C	62	GYC	CB1-SG1	-11.56	1.57	1.81
1	A	62	GYC	CB1-SG1	-11.54	1.57	1.81
1	B	62	GYC	CB1-SG1	-11.50	1.57	1.81
1	E	62	GYC	CB1-SG1	-11.48	1.57	1.81

The worst 5 of 44 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	62	GYC	C2-N3-C1	12.05	114.07	107.97
1	B	62	GYC	C2-N3-C1	11.91	114.00	107.97
1	E	62	GYC	C2-N3-C1	11.88	113.98	107.97
1	D	62	GYC	C2-N3-C1	11.82	113.95	107.97
1	F	62	GYC	C2-N3-C1	11.56	113.82	107.97

There are no chirality outliers.

5 of 13 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	62	GYC	C3-CA3-N3-C2
1	B	62	GYC	C3-CA3-N3-C2
1	C	62	GYC	C3-CA3-N3-C2
1	D	62	GYC	C3-CA3-N3-C2
1	E	62	GYC	C3-CA3-N3-C2

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates (i)

There are no monosaccharides 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)

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains (i)

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates (i)

EDS was not executed - this section is therefore empty.

6.4 Ligands (i)

EDS was not executed - this section is therefore empty.

6.5 Other polymers (i)

EDS was not executed - this section is therefore empty.