wwPDB X-ray Structure Validation Summary Report (i)

Aug 14, 2023 – 04:22 pm BST

PDB ID	:	8AQH
Title	:	NanoLuc-Y94A luciferase mutant
Authors	:	Nemergut, M.; Marek, M.
Deposited on	:	2022-08-12
Resolution	:	2.80 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:

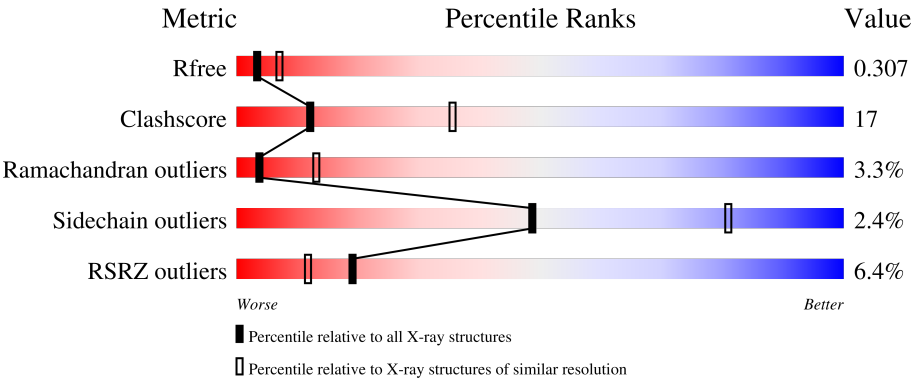
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35

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 2.80 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	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)

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% 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	181	6% 61% 32% · 5%
1	B	181	6% 60% 31% · 6%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 2702 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 NanoLuc luciferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	172	Total	C	N	O	S	0	0	0
			1350	869	227	250	4			
1	B	170	Total	C	N	O	S	0	0	0
			1336	862	224	246	4			

There are 58 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-11	MET	-	initiating methionine	UNP Q9GV45
A	-10	HIS	-	expression tag	UNP Q9GV45
A	-9	HIS	-	expression tag	UNP Q9GV45
A	-8	HIS	-	expression tag	UNP Q9GV45
A	-7	HIS	-	expression tag	UNP Q9GV45
A	-6	HIS	-	expression tag	UNP Q9GV45
A	-5	HIS	-	expression tag	UNP Q9GV45
A	-4	SER	-	expression tag	UNP Q9GV45
A	-3	ASP	-	expression tag	UNP Q9GV45
A	-2	ASN	-	expression tag	UNP Q9GV45
A	-1	MET	-	expression tag	UNP Q9GV45
A	0	VAL	-	expression tag	UNP Q9GV45
A	4	GLU	ALA	engineered mutation	UNP Q9GV45
A	11	ARG	GLN	engineered mutation	UNP Q9GV45
A	18	LEU	GLN	engineered mutation	UNP Q9GV45
A	27	VAL	LEU	engineered mutation	UNP Q9GV45
A	33	ASN	ALA	engineered mutation	UNP Q9GV45
A	43	ARG	LYS	engineered mutation	UNP Q9GV45
A	44	ILE	VAL	engineered mutation	UNP Q9GV45
A	54	ILE	ALA	engineered mutation	UNP Q9GV45
A	68	ASP	PHE	engineered mutation	UNP Q9GV45
A	72	GLN	LEU	engineered mutation	UNP Q9GV45
A	75	LYS	MET	engineered mutation	UNP Q9GV45
A	90	VAL	ILE	engineered mutation	UNP Q9GV45
A	94	ALA	TYR	engineered mutation	UNP Q9GV45

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Chain	Residue	Modelled	Actual	Comment	Reference
A	115	GLU	PRO	engineered mutation	UNP Q9GV45
A	124	LYS	GLN	engineered mutation	UNP Q9GV45
A	138	ILE	TYR	engineered mutation	UNP Q9GV45
A	166	ARG	ASN	engineered mutation	UNP Q9GV45
B	-11	MET	-	initiating methionine	UNP Q9GV45
B	-10	HIS	-	expression tag	UNP Q9GV45
B	-9	HIS	-	expression tag	UNP Q9GV45
B	-8	HIS	-	expression tag	UNP Q9GV45
B	-7	HIS	-	expression tag	UNP Q9GV45
B	-6	HIS	-	expression tag	UNP Q9GV45
B	-5	HIS	-	expression tag	UNP Q9GV45
B	-4	SER	-	expression tag	UNP Q9GV45
B	-3	ASP	-	expression tag	UNP Q9GV45
B	-2	ASN	-	expression tag	UNP Q9GV45
B	-1	MET	-	expression tag	UNP Q9GV45
B	0	VAL	-	expression tag	UNP Q9GV45
B	4	GLU	ALA	engineered mutation	UNP Q9GV45
B	11	ARG	GLN	engineered mutation	UNP Q9GV45
B	18	LEU	GLN	engineered mutation	UNP Q9GV45
B	27	VAL	LEU	engineered mutation	UNP Q9GV45
B	33	ASN	ALA	engineered mutation	UNP Q9GV45
B	43	ARG	LYS	engineered mutation	UNP Q9GV45
B	44	ILE	VAL	engineered mutation	UNP Q9GV45
B	54	ILE	ALA	engineered mutation	UNP Q9GV45
B	68	ASP	PHE	engineered mutation	UNP Q9GV45
B	72	GLN	LEU	engineered mutation	UNP Q9GV45
B	75	LYS	MET	engineered mutation	UNP Q9GV45
B	90	VAL	ILE	engineered mutation	UNP Q9GV45
B	94	ALA	TYR	engineered mutation	UNP Q9GV45
B	115	GLU	PRO	engineered mutation	UNP Q9GV45
B	124	LYS	GLN	engineered mutation	UNP Q9GV45
B	138	ILE	TYR	engineered mutation	UNP Q9GV45
B	166	ARG	ASN	engineered mutation	UNP Q9GV45

- Molecule 2 is water.

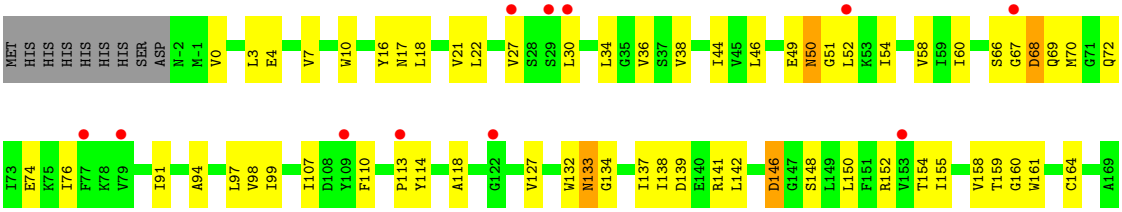
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	9	Total O 9 9	0	0
2	B	7	Total O 7 7	0	0

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.

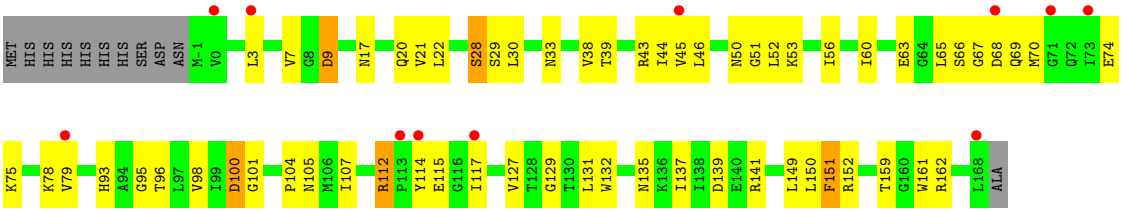
- Molecule 1: NanoLuc luciferase

Chain A:



- Molecule 1: NanoLuc luciferase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 2	Depositor
Cell constants a, b, c, α, β, γ	86.45Å 86.47Å 96.24Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.22 – 2.80 43.22 – 2.80	Depositor EDS
% Data completeness (in resolution range)	99.8 (43.22-2.80) 99.8 (43.22-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.29 (at 2.81Å)	Xtriage
Refinement program	PHENIX 1.20.1-4487	Depositor
R, R_{free}	0.261 , 0.305 0.261 , 0.307	Depositor DCC
R_{free} test set	430 reflections (4.68%)	wwPDB-VP
Wilson B-factor (Å^2)	74.9	Xtriage
Anisotropy	0.199	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 56.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.35$, $< L^2 > = 0.18$	Xtriage
Estimated twinning fraction	0.460 for -k,-h,-l	Xtriage
Reported twinning fraction	0.500 for -k,-h,-l	Depositor
Outliers	0 of 9193 reflections	Xtriage
F_o,F_c correlation	0.89	EDS
Total number of atoms	2702	wwPDB-VP
Average B, all atoms (Å^2)	67.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.41% 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	0.26	0/1378	0.49	0/1870
1	B	0.24	0/1364	0.50	0/1852
All	All	0.25	0/2742	0.50	0/3722

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	1350	0	1355	53	0
1	B	1336	0	1344	42	0
2	A	9	0	0	0	0
2	B	7	0	0	0	0
All	All	2702	0	2699	92	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 17.

The worst 5 of 92 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:21:VAL:HG23	1:A:22:LEU:HD13	1.31	1.07

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:21:VAL:HG23	1:A:22:LEU:CD1	2.06	0.86
1:A:137:ILE:HG13	1:A:155:ILE:HG12	1.68	0.75
1:B:105:ASN:O	1:B:115:GLU:HA	1.88	0.73
1:B:74:GLU:O	1:B:78:LYS:N	2.24	0.71

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	170/181 (94%)	144 (85%)	20 (12%)	6 (4%)	3 12
1	B	168/181 (93%)	143 (85%)	20 (12%)	5 (3%)	4 15
All	All	338/362 (93%)	287 (85%)	40 (12%)	11 (3%)	4 13

5 of 11 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	0	VAL
1	B	66	SER
1	A	67	GLY
1	A	146	ASP
1	B	50	ASN

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	148/157 (94%)	147 (99%)	1 (1%)	84 95
1	B	147/157 (94%)	141 (96%)	6 (4%)	30 64
All	All	295/314 (94%)	288 (98%)	7 (2%)	49 81

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

Mol	Chain	Res	Type
1	B	43	ARG
1	B	63	GLU
1	B	151	PHE
1	B	112	ARG
1	B	28	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 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

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	172/181 (95%)	0.46	11 (6%)	19	12	29, 69, 89, 98	0
1	B	170/181 (93%)	0.36	11 (6%)	18	11	38, 66, 88, 101	0
All	All	342/362 (94%)	0.41	22 (6%)	19	12	29, 67, 89, 101	0

The worst 5 of 22 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	30	LEU	4.8
1	B	79	VAL	4.5
1	A	52	LEU	3.3
1	B	71	GLY	3.2
1	A	77	PHE	3.0

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

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

6.3 Carbohydrates

There are no monosaccharides in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.