wwPDB X-ray Structure Validation Summary Report (i)

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PDB ID	:	7OZT
Title	:	Nanobodies restore stability to cancer-associated mutants of tumor suppressor protein p16INK4a
Authors	:	Pastok, M.W.; Burbidge, O.; Itzhaki, L.; Endicott, J.A.; Noble, M.E.M.
Deposited on	:	2021-06-28
Resolution	:	1.74 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 (1)) were used in the production of this report:

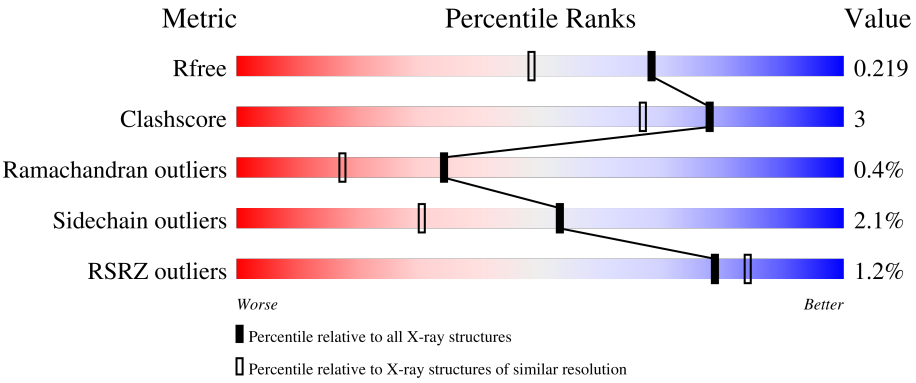
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.29
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0267
CCP4	:	7.1.010 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.29

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 1.74 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	3764 (1.76-1.72)
Clashscore	141614	3923 (1.76-1.72)
Ramachandran outliers	138981	3878 (1.76-1.72)
Sidechain outliers	138945	3878 (1.76-1.72)
RSRZ outliers	127900	3705 (1.76-1.72)

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	AAA	132	2% 87% 5% 8%
2	BBB	175	% 59% 11% 29%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 3830 atoms, of which 1860 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 Camelid nanobody NB09.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	AAA	122	1812	566	894	164	180	8	29	2	0

- Molecule 2 is a protein called Cyclin-dependent kinase inhibitor 2A.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
2	BBB	125	1928	596	966	186	174	6	19	2	0

There are 19 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
BBB	-18	MET	-	initiating methionine	UNP P42771
BBB	-17	ALA	-	expression tag	UNP P42771
BBB	-16	HIS	-	expression tag	UNP P42771
BBB	-15	HIS	-	expression tag	UNP P42771
BBB	-14	HIS	-	expression tag	UNP P42771
BBB	-13	HIS	-	expression tag	UNP P42771
BBB	-12	HIS	-	expression tag	UNP P42771
BBB	-11	HIS	-	expression tag	UNP P42771
BBB	-10	SER	-	expression tag	UNP P42771
BBB	-9	SER	-	expression tag	UNP P42771
BBB	-8	GLY	-	expression tag	UNP P42771
BBB	-7	LEU	-	expression tag	UNP P42771
BBB	-6	GLU	-	expression tag	UNP P42771
BBB	-5	VAL	-	expression tag	UNP P42771
BBB	-4	LEU	-	expression tag	UNP P42771
BBB	-3	PHE	-	expression tag	UNP P42771
BBB	-2	GLN	-	expression tag	UNP P42771
BBB	-1	GLY	-	expression tag	UNP P42771
BBB	0	PRO	-	expression tag	UNP P42771

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	AAA	43	Total O 43 43	0	0
3	BBB	47	Total O 47 47	0	0

3 Residue-property plots (i)

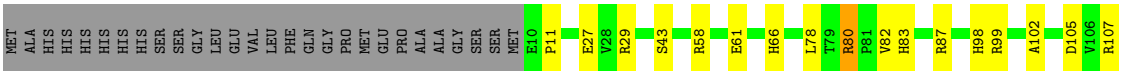
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density.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

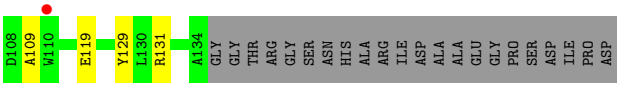
- Molecule 1: Camelid nanobody NB09

Chain AAA:

- Molecule 2: Cyclin-dependent kinase inhibitor 2A

Chain BBB:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	42.12Å 182.93Å 65.22Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	91.47 – 1.74 91.47 – 1.74	Depositor EDS
% Data completeness (in resolution range)	100.0 (91.47-1.74) 100.0 (91.47-1.74)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.68 (at 1.74Å)	Xtriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.180 , 0.209 0.192 , 0.219	Depositor DCC
R_{free} test set	930 reflections (3.52%)	wwPDB-VP
Wilson B-factor (Å^2)	23.5	Xtriage
Anisotropy	0.223	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	(Not available) , (Not available)	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	3830	wwPDB-VP
Average B, all atoms (Å^2)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.82% 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	AAA	0.90	0/933	1.12	1/1259 (0.1%)
2	BBB	1.02	2/980 (0.2%)	1.16	6/1333 (0.5%)
All	All	0.97	2/1913 (0.1%)	1.14	7/2592 (0.3%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	BBB	61	GLU	CD-OE1	5.96	1.32	1.25
2	BBB	27	GLU	CD-OE1	5.48	1.31	1.25

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	BBB	99	ARG	NE-CZ-NH2	10.54	125.57	120.30
2	BBB	99	ARG	NE-CZ-NH1	-8.03	116.29	120.30
1	AAA	40	ARG	NE-CZ-NH2	-5.90	117.35	120.30
2	BBB	80	ARG	NE-CZ-NH2	-5.62	117.49	120.30
2	BBB	29	ARG	NE-CZ-NH1	5.27	122.93	120.30

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	AAA	918	894	892	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	BBB	962	966	959	9	1
3	AAA	43	0	0	1	0
3	BBB	47	0	0	2	0
All	All	1970	1860	1851	11	1

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 3.

The worst 5 of 11 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)
2:BBB:80:ARG:H	2:BBB:83:HIS:HD2	1.24	0.85
3:AAA:237:HOH:O	2:BBB:98:HIS:HE1	1.77	0.67
2:BBB:80:ARG:H	2:BBB:83:HIS:CD2	2.12	0.63
2:BBB:98:HIS:HD2	2:BBB:129:TYR:OH	1.88	0.57
2:BBB:87:ARG:HD2	3:BBB:228:HOH:O	2.15	0.47

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:BBB:58:ARG:HG3	2:BBB:58:ARG:HG3[3_554]	1.26	0.34

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	AAA	122/132 (92%)	122 (100%)	0	0	100 100
2	BBB	125/175 (71%)	121 (97%)	3 (2%)	1 (1%)	19 6
All	All	247/307 (80%)	243 (98%)	3 (1%)	1 (0%)	34 17

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	BBB	43	SER

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	AAA	97/104 (93%)	95 (98%)	2 (2%)	53	30
2	BBB	94/129 (73%)	92 (98%)	2 (2%)	53	30
All	All	191/233 (82%)	187 (98%)	4 (2%)	53	30

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	AAA	13	GLN
1	AAA	64	ASP
2	BBB	11	PRO
2	BBB	105	ASP

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	AAA	122/132 (92%)	-0.11	2 (1%)	72	78	18, 28, 52, 76	0
2	BBB	125/175 (71%)	-0.06	1 (0%)	86	90	15, 25, 50, 65	0
All	All	247/307 (80%)	-0.08	3 (1%)	79	84	15, 27, 51, 76	0

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	AAA	110	GLY	4.7
2	BBB	110	TRP	2.3
1	AAA	43	PRO	2.3

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.