wwPDB X-ray Structure Validation Summary Report (i)

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PDB ID	:	7QHI / pdb_00007qhi
Title	:	Crystal structure of cytotoxin 13 from Naja naja, hexagonal form
Authors	:	Samygina, V.R.; Dubova, K.M.; Bourenkov, G.; Utkin, Y.N.; Dubovskii, P.V.
Deposited on	:	2021-12-12
Resolution	:	2.30 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:

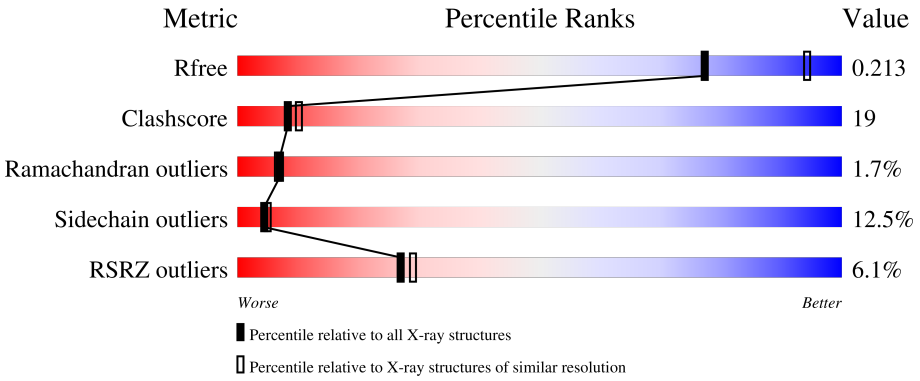
MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	60	73% 15% 8% ·
1	BBB	60	73% 22% · ·
1	CCC	60	18% 57% 28% 12% ·

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 1609 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 Cytotoxin 13.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	AAA	60	Total	C	N	O	S	0	0	0
			464	294	81	79	10			
1	BBB	60	Total	C	N	O	S	0	0	0
			464	294	81	79	10			
1	CCC	60	Total	C	N	O	S	0	0	0
			464	294	81	79	10			

- Molecule 2 is water.

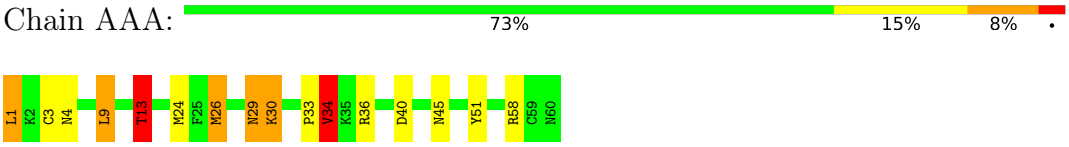
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	AAA	91	Total	O	0	0
			91	91		
2	BBB	76	Total	O	0	0
			76	76		
2	CCC	50	Total	O	0	0
			50	50		

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.

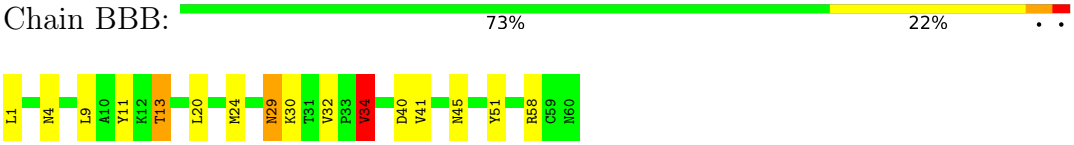
• Molecule 1: Cytotoxin 13

Chain AAA:



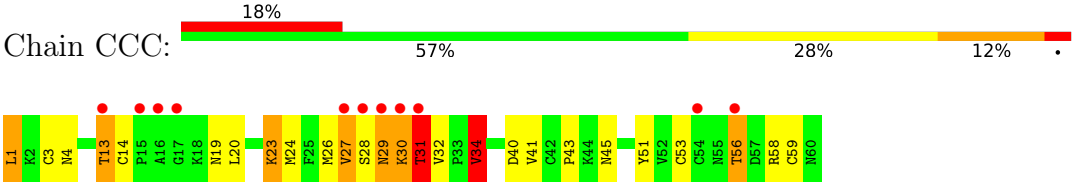
• Molecule 1: Cytotoxin 13

Chain BBB:



• Molecule 1: Cytotoxin 13

Chain CCC:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 64 2 2	Depositor
Cell constants a, b, c, α, β, γ	109.33Å 109.33Å 135.77Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	14.90 – 2.30 14.90 – 2.30	Depositor EDS
% Data completeness (in resolution range)	98.4 (14.90-2.30) 98.3 (14.90-2.30)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	6.43 (at 2.29Å)	Xtriage
Refinement program	REFMAC 5.8.0257	Depositor
R, R_{free}	0.199 , 0.228 0.203 , 0.213	Depositor DCC
R_{free} test set	1084 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å^2)	32.5	Xtriage
Anisotropy	0.186	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 51.0	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	0.94	EDS
Total number of atoms	1609	wwPDB-VP
Average B, all atoms (Å^2)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.03% 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	1.07	1/471 (0.2%)	1.37	4/632 (0.6%)
1	BBB	1.06	0/471	1.42	5/632 (0.8%)
1	CCC	1.15	0/471	1.58	3/632 (0.5%)
All	All	1.09	1/1413 (0.1%)	1.46	12/1896 (0.6%)

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	CCC	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	AAA	33	PRO	C-O	-5.78	1.16	1.23

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	AAA	34	VAL	N-CA-CB	-8.64	102.05	112.33
1	CCC	34	VAL	N-CA-CB	-8.59	102.76	112.21
1	BBB	13	THR	CB-CA-C	8.24	123.98	110.22
1	BBB	34	VAL	N-CA-CB	-7.49	103.97	112.21
1	AAA	13	THR	CB-CA-C	6.67	120.76	109.75

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	CCC	53	CYS	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	AAA	464	0	492	22	0
1	BBB	464	0	492	16	0
1	CCC	464	0	492	22	0
2	AAA	91	0	0	9	0
2	BBB	76	0	0	6	0
2	CCC	50	0	0	3	0
All	All	1609	0	1476	55	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 19.

The worst 5 of 55 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:BBB:9:LEU:CD1	2:BBB:139:HOH:O	2.26	0.84
1:BBB:4:ASN:HD21	1:BBB:58:ARG:HE	1.29	0.81
1:BBB:9:LEU:HD12	2:BBB:139:HOH:O	1.81	0.80
1:AAA:4:ASN:HD21	1:AAA:58:ARG:HE	1.32	0.74
1:AAA:9:LEU:HD21	1:BBB:34:VAL:HG13	1.68	0.74

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	AAA	58/60 (97%)	55 (95%)	3 (5%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	BBB	58/60 (97%)	57 (98%)	1 (2%)	0	100 100
1	CCC	58/60 (97%)	51 (88%)	4 (7%)	3 (5%)	1 1
All	All	174/180 (97%)	163 (94%)	8 (5%)	3 (2%)	7 7

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	CCC	27	VAL
1	CCC	30	LYS
1	CCC	31	THR

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	56/56 (100%)	49 (88%)	7 (12%)	4 5
1	BBB	56/56 (100%)	50 (89%)	6 (11%)	6 8
1	CCC	56/56 (100%)	48 (86%)	8 (14%)	3 3
All	All	168/168 (100%)	147 (88%)	21 (12%)	4 5

5 of 21 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	CCC	13	THR
1	CCC	29	ASN
1	CCC	56	THR
1	CCC	34	VAL
1	CCC	28	SER

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

5.3.3 RNA

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates

There are no oligosaccharides in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

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	60/60 (100%)	-0.37	0 100 100	26, 37, 52, 64	0
1	BBB	60/60 (100%)	-0.44	0 100 100	23, 33, 46, 60	0
1	CCC	60/60 (100%)	0.66	11 (18%) 3 4	25, 54, 87, 97	0
All	All	180/180 (100%)	-0.05	11 (6%) 27 29	23, 37, 79, 97	0

The worst 5 of 11 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	CCC	54	CYS	5.1
1	CCC	29	ASN	4.0
1	CCC	28	SER	3.9
1	CCC	56	THR	3.4
1	CCC	31	THR	2.7

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 oligosaccharides in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.