Full wwPDB X-ray Structure Validation Report (i)

Oct 6, 2021 – 04:06 am BST

PDB ID	:	6XYR
Title	:	Structure of the T4Lnano fusion protein
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Deposited on	:	2020-01-31
Resolution	:	2.08 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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 following versions of software and data (see references (1)) were used in the production of this report:

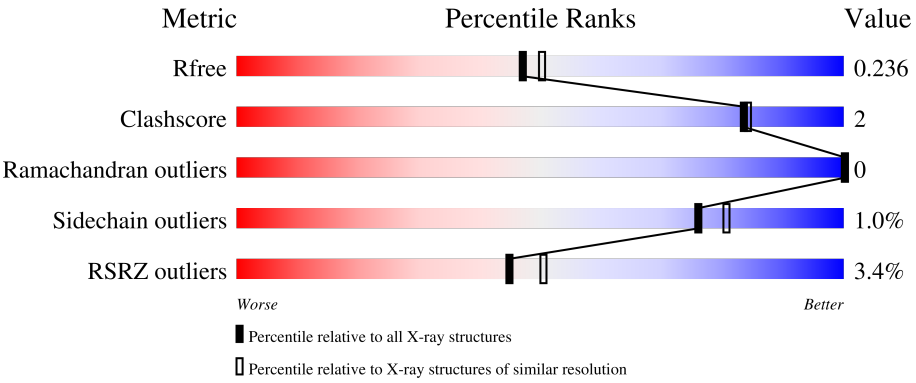
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.23.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0267
CCP4	:	7.1.010 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

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 2.08 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	6189 (2.10-2.06)
Clashscore	141614	6738 (2.10-2.06)
Ramachandran outliers	138981	6663 (2.10-2.06)
Sidechain outliers	138945	6664 (2.10-2.06)
RSRZ outliers	127900	6057 (2.10-2.06)

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	361	3% 89% 7% .

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 5726 atoms, of which 2771 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 T4Lnano,Endolysin,Calmodulin,Endolysin,Calmodulin-1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	348	Total	C	H	N	O	S	201	0	0
			5515	1733	2732	483	551	16			

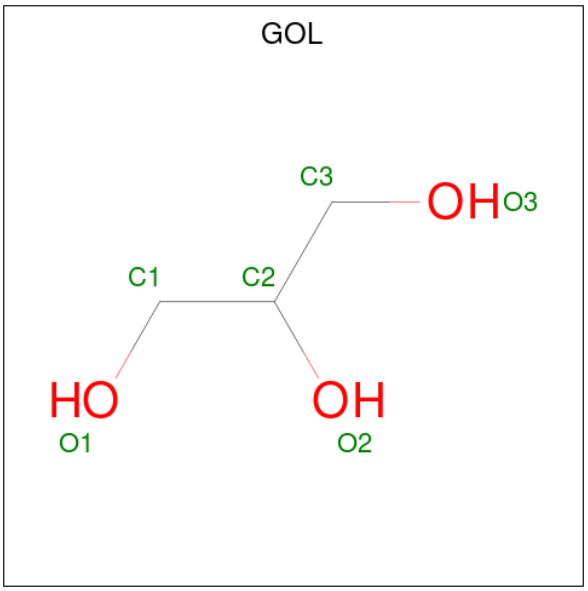
There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	47	GLY	ARG	engineered mutation	UNP P00720
A	172	ARG	ILE	engineered mutation	UNP P00720
A	200	GLY	-	linker	UNP P00720
A	201	GLU	-	linker	UNP P00720
A	202	ASN	-	linker	UNP P00720
A	203	LEU	-	linker	UNP P00720
A	204	TYR	-	linker	UNP P00720
A	205	PHE	-	linker	UNP P00720
A	206	GLN	-	linker	UNP P00720
A	207	SER	-	linker	UNP P00720
A	208	GLY	-	linker	UNP P00720
A	209	GLY	-	linker	UNP P00720
A	210	SER	-	linker	UNP P00720
A	211	ALA	-	linker	UNP P00720
A	212	ALA	-	linker	UNP P00720
A	213	ALA	-	linker	UNP P00720

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	5	Total	Ca	0	0
			5	5		

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C H O 14 3 8 3	0	0
3	A	1	Total C H O 14 3 8 3	0	0
3	A	1	Total C H O 14 3 8 3	0	0
3	A	1	Total C H O 13 3 7 3	0	0
3	A	1	Total C H O 14 3 8 3	0	0

- Molecule 4 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	2	Total Cl 2 2	0	0

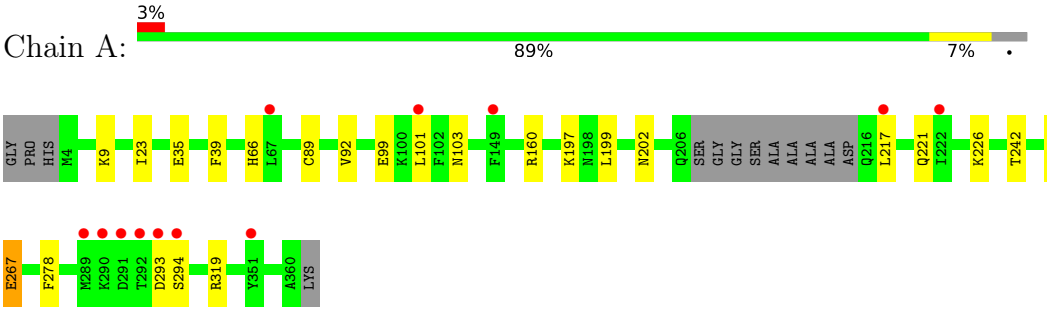
- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	135	Total O 135 135	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: T4Lnano,Endolysin,Calmodulin,Endolysin,Calmodulin-1



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α, β, γ	86.38Å 104.26Å 63.95Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.10 – 2.08 46.10 – 2.08	Depositor EDS
% Data completeness (in resolution range)	99.9 (46.10-2.08) 99.9 (46.10-2.08)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.58 (at 2.08Å)	Xtriage
Refinement program	PHENIX 1.11.1_2575	Depositor
R, R_{free}	0.191 , 0.236 0.192 , 0.236	Depositor DCC
R_{free} test set	1799 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å^2)	41.7	Xtriage
Anisotropy	0.440	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	(Not available) , (Not available)	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	5726	wwPDB-VP
Average B, all atoms (Å^2)	56.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.58% 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

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, CA, CL

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	0.51	0/2821	0.64	0/3787

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	2783	2732	2731	13	0
2	A	5	0	0	0	0
3	A	30	39	39	0	0
4	A	2	0	0	1	0
5	A	135	0	0	1	0
All	All	2955	2771	2770	13	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 2.

All (13) 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:160:ARG:NH2	4:A:411:CL:CL	2.64	0.54
1:A:242:THR:HG22	1:A:265:ILE:HG13	1.91	0.53
1:A:197:LYS:O	1:A:199:LEU:O	2.28	0.52
1:A:293:ASP:OD1	1:A:294:SER:N	2.46	0.48
1:A:89:CYS:HB3	1:A:92:VAL:O	2.14	0.47
1:A:242:THR:HG21	1:A:262:GLN:OE1	2.16	0.46
1:A:35:GLU:OE2	1:A:103:ASN:OD1	2.33	0.46
1:A:319:ARG:NH1	5:A:508:HOH:O	2.46	0.45
1:A:39:PHE:CE1	1:A:99:GLU:HG2	2.54	0.43
1:A:23:ILE:HG22	1:A:267:GLU:HG2	2.01	0.43
1:A:217:LEU:HD12	1:A:221:GLN:OE1	2.20	0.41
1:A:66:HIS:ND1	1:A:101:LEU:HD22	2.36	0.41
1:A:226:LYS:HG2	1:A:278:PHE:CZ	2.55	0.40

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	344/361 (95%)	338 (98%)	6 (2%)	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	295/301 (98%)	292 (99%)	3 (1%)	76 81

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	9	LYS
1	A	202	ASN
1	A	267	GLU

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)

Of 12 ligands modelled in this entry, 7 are monoatomic - leaving 5 for Mogul analysis.

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	$\#\|Z\| > 2$
3	GOL	A	410	-	5,5,5	0.49	0	5,5,5	0.63	0
3	GOL	A	409	-	5,5,5	1.06	1 (20%)	5,5,5	1.59	1 (20%)
3	GOL	A	407	-	5,5,5	0.25	0	5,5,5	0.42	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
3	GOL	A	406	-	5,5,5	0.40	0	5,5,5	0.16	0
3	GOL	A	408	-	5,5,5	0.42	0	5,5,5	0.19	0

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
3	GOL	A	410	-	-	2/4/4/4	-
3	GOL	A	409	-	-	2/4/4/4	-
3	GOL	A	407	-	-	0/4/4/4	-
3	GOL	A	406	-	-	2/4/4/4	-
3	GOL	A	408	-	-	0/4/4/4	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	409	GOL	O2-C2	-2.26	1.36	1.43

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	409	GOL	O2-C2-C1	-2.13	99.75	109.12

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	406	GOL	O1-C1-C2-C3
3	A	410	GOL	C1-C2-C3-O3
3	A	409	GOL	C1-C2-C3-O3
3	A	410	GOL	O2-C2-C3-O3
3	A	406	GOL	O1-C1-C2-O2
3	A	409	GOL	O1-C1-C2-O2

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

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	348/361 (96%)	0.77	12 (3%) 45 50	34, 48, 69, 99	25 (7%)

All (12) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	217	LEU	4.6
1	A	294	SER	3.6
1	A	289	MET	3.2
1	A	291	ASP	2.5
1	A	292	THR	2.4
1	A	290	LYS	2.4
1	A	293	ASP	2.3
1	A	351	TYR	2.3
1	A	149	PHE	2.3
1	A	67	LEU	2.2
1	A	222	ILE	2.1
1	A	101	LEU	2.0

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

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^{th} 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^2)	Q<0.9
3	GOL	A	410	6/6	0.63	0.26	59,80,89,96	0
3	GOL	A	408	6/6	0.83	0.29	69,83,99,99	0
3	GOL	A	409	6/6	0.87	0.27	49,67,81,85	0
3	GOL	A	407	6/6	0.87	0.37	62,75,87,90	0
3	GOL	A	406	6/6	0.91	0.23	57,68,74,79	0
4	CL	A	412	1/1	0.94	0.17	57,57,57,57	0
4	CL	A	411	1/1	0.97	0.13	57,57,57,57	0
2	CA	A	405	1/1	0.98	0.12	66,66,66,66	0
2	CA	A	401	1/1	0.99	0.16	41,41,41,41	0
2	CA	A	402	1/1	0.99	0.24	37,37,37,37	0
2	CA	A	403	1/1	0.99	0.15	45,45,45,45	0
2	CA	A	404	1/1	0.99	0.15	55,55,55,55	0

6.5 Other polymers (i)

There are no such residues in this entry.