Full wwPDB X-ray Structure Validation Report (i)

Sep 12, 2023 – 12:25 AM EDT

PDB ID	:	4MVI
Title	:	Crystal structure of an engineered lipocalin (Anticalin US7) in complex with the Alzheimer amyloid peptide Abeta(1-40)
Authors	:	Eichinger, A.; Skerra, A.
Deposited on	:	2013-09-24
Resolution	:	1.70 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 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:

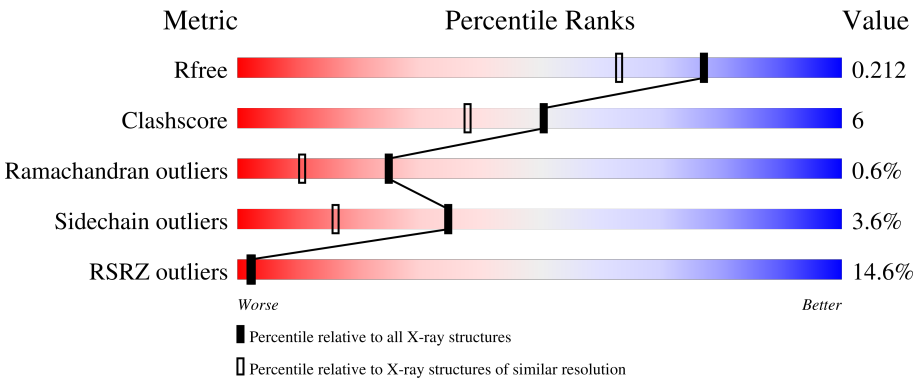
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

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))
R_{free}	130704	4298 (1.70-1.70)
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)
RSRZ outliers	127900	4222 (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% 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	188	12%; 80%; 11%; • ; 9%
2	B	40	12%; 30%; • ; 68%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 1577 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 Neutrophil gelatinase-associated lipocalin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	172	1394	895	243	252	4	0	0	0

There are 29 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	28	HIS	GLN	engineered mutation	UNP P80188
A	36	VAL	LEU	engineered mutation	UNP P80188
A	40	LYS	ALA	engineered mutation	UNP P80188
A	41	SER	ILE	engineered mutation	UNP P80188
A	49	TRP	GLN	engineered mutation	UNP P80188
A	70	GLY	LEU	engineered mutation	UNP P80188
A	72	GLY	ARG	engineered mutation	UNP P80188
A	73	THR	LYS	engineered mutation	UNP P80188
A	77	HIS	ASP	engineered mutation	UNP P80188
A	79	LYS	TRP	engineered mutation	UNP P80188
A	87	SER	CYS	engineered mutation	UNP P80188
A	96	ARG	ASN	engineered mutation	UNP P80188
A	100	ARG	TYR	engineered mutation	UNP P80188
A	103	ARG	LEU	engineered mutation	UNP P80188
A	106	ALA	TYR	engineered mutation	UNP P80188
A	125	VAL	LYS	engineered mutation	UNP P80188
A	127	GLN	SER	engineered mutation	UNP P80188
A	132	SER	TYR	engineered mutation	UNP P80188
A	134	ASN	LYS	engineered mutation	UNP P80188
A	179	SER	-	expression tag	UNP P80188
A	180	ALA	-	expression tag	UNP P80188
A	181	TRP	-	expression tag	UNP P80188
A	182	SER	-	expression tag	UNP P80188
A	183	HIS	-	expression tag	UNP P80188
A	184	PRO	-	expression tag	UNP P80188
A	185	GLN	-	expression tag	UNP P80188
A	186	PHE	-	expression tag	UNP P80188

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Chain	Residue	Modelled	Actual	Comment	Reference
A	187	GLU	-	expression tag	UNP P80188
A	188	LYS	-	expression tag	UNP P80188

- Molecule 2 is a protein called Beta-amyloid protein 40.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	B	13	102	67	16	19	0	0	0

- Molecule 3 is water.

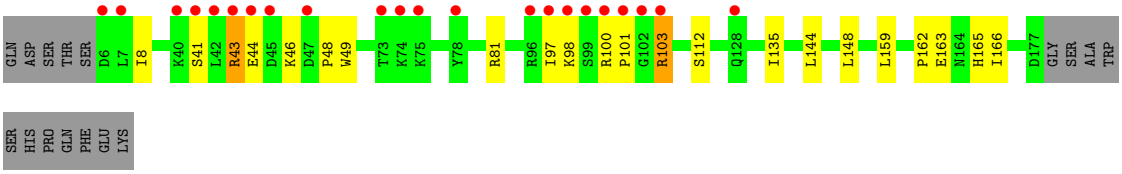
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	77	77	77	0	0
			Total	O		
3	B	4	4	4	0	0

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.

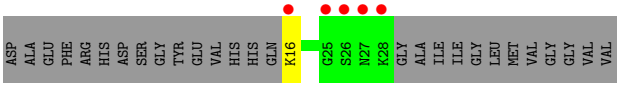
• Molecule 1: Neutrophil gelatinase-associated lipocalin

Chain A:



• Molecule 2: Beta-amyloid protein 40

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	48.95Å 58.93Å 61.23Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	42.46 – 1.70 29.46 – 1.70	Depositor EDS
% Data completeness (in resolution range)	99.7 (42.46-1.70) 99.7 (29.46-1.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.06	Depositor
$< I/\sigma(I) >$ [1]	6.33 (at 1.70Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.169 , 0.212 0.168 , 0.212	Depositor DCC
R_{free} test set	1021 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å^2)	17.0	Xtriage
Anisotropy	0.971	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.39 , 54.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.026 for -h,l,k	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	1577	wwPDB-VP
Average B, all atoms (Å^2)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.76% 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 (i)

5.1 Standard geometry (i)

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	1.03	2/1430 (0.1%)	0.99	0/1934
2	B	0.99	0/103	1.05	0/136
All	All	1.03	2/1533 (0.1%)	1.00	0/2070

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	112	SER	CB-OG	5.87	1.49	1.42
1	A	49	TRP	CD2-CE2	5.68	1.48	1.41

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	1394	0	1392	17	0
2	B	102	0	101	0	0
3	A	77	0	0	1	0
3	B	4	0	0	0	0
All	All	1577	0	1493	17	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 6.

All (17) 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:100:ARG:O	1:A:103:ARG:HB2	1.89	0.72
1:A:135:ILE:HD11	1:A:159:LEU:HD12	1.79	0.65
1:A:43:ARG:O	1:A:46:LYS:HD3	1.99	0.61
1:A:97:ILE:HG22	1:A:98:LYS:N	2.16	0.60
1:A:97:ILE:HG22	1:A:98:LYS:H	1.69	0.57
1:A:163:GLU:HA	1:A:166:ILE:HD12	1.89	0.55
1:A:8:ILE:CD1	1:A:162:PRO:CD	2.87	0.53
1:A:8:ILE:CD1	1:A:162:PRO:HD3	2.42	0.49
1:A:100:ARG:HB2	1:A:103:ARG:HD3	1.98	0.46
1:A:100:ARG:HB2	1:A:103:ARG:CD	2.47	0.45
1:A:97:ILE:CG2	1:A:98:LYS:H	2.31	0.44
1:A:8:ILE:HD11	1:A:162:PRO:CD	2.49	0.43
1:A:97:ILE:CG2	1:A:98:LYS:N	2.82	0.43
1:A:48:PRO:HA	3:A:267:HOH:O	2.20	0.42
1:A:162:PRO:HG2	1:A:165:HIS:ND1	2.35	0.42
1:A:144:LEU:CD1	1:A:148:LEU:HD23	2.51	0.41
1:A:8:ILE:HD13	1:A:162:PRO:HD3	2.04	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	170/188 (90%)	159 (94%)	10 (6%)	1 (1%)	25 11
2	B	11/40 (28%)	9 (82%)	2 (18%)	0	100 100
All	All	181/228 (79%)	168 (93%)	12 (7%)	1 (1%)	25 11

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	101	PRO

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	156/170 (92%)	151 (97%)	5 (3%)	39	20
2	B	11/31 (36%)	10 (91%)	1 (9%)	9	2
All	All	167/201 (83%)	161 (96%)	6 (4%)	35	16

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	41	SER
1	A	43	ARG
1	A	44	GLU
1	A	81	ARG
1	A	103	ARG
2	B	16	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	26	GLN

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 (i)

6.1 Protein, DNA and RNA chains (i)

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, 95th 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	172/188 (91%)	0.74	22 (12%)	3	4	11, 21, 82, 129	0
2	B	13/40 (32%)	1.03	5 (38%)	0	0	13, 22, 67, 78	0
All	All	185/228 (81%)	0.76	27 (14%)	2	2	11, 21, 80, 129	0

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	101	PRO	14.2
1	A	102	GLY	13.9
1	A	97	ILE	9.1
1	A	42	LEU	9.0
1	A	41	SER	8.9
1	A	100	ARG	8.7
1	A	98	LYS	6.5
1	A	43	ARG	5.7
1	A	6	ASP	5.0
2	B	27	ASN	4.8
2	B	28	LYS	4.7
1	A	7	LEU	4.0
1	A	99	SER	3.7
1	A	103	ARG	3.5
1	A	78	TYR	3.1
1	A	96	ARG	3.0
1	A	45	ASP	3.0
1	A	44	GLU	2.9
2	B	16	LYS	2.7
1	A	73	THR	2.6
1	A	47	ASP	2.5
1	A	128	GLN	2.4
1	A	74	LYS	2.3
2	B	26	SER	2.3

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Mol	Chain	Res	Type	RSRZ
2	B	25	GLY	2.3
1	A	40	LYS	2.1
1	A	75	LYS	2.0

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

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

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.