



wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 28, 2024 – 10:43 am GMT

PDB ID : 4YU5
Title : Crystal structure of selenomethionine variant of Bacillus anthracis immune inhibitor A2 peptidase zymogen
Authors : Arolas, J.L.; Goulas, T.; Gomis-Ruth, F.X.
Deposited on : 2015-03-18
Resolution : 2.90 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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

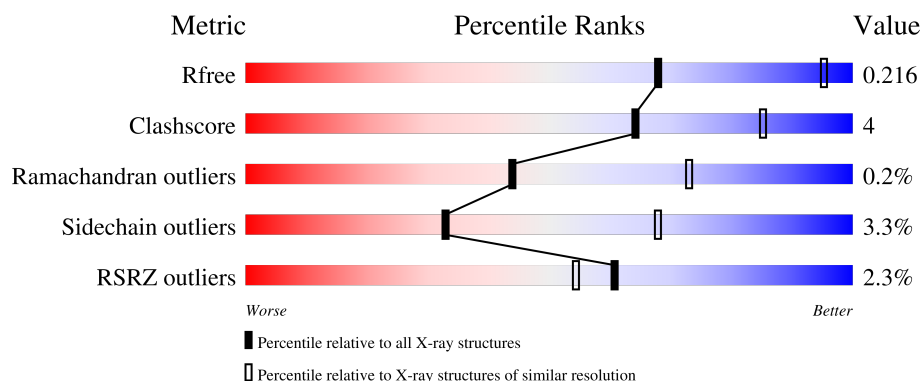
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION



The reported resolution of this entry is 2.90 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}	164625	2335 (2.90-2.90)
Clashscore	180529	2564 (2.90-2.90)
Ramachandran outliers	177936	2514 (2.90-2.90)
Sidechain outliers	177891	2516 (2.90-2.90)
RSRZ outliers	164620	2337 (2.90-2.90)

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 $\leq 5\%$. 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	756	 82% 9% • 8%
1	B	756	 83% 8% • 9%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	KH2	A	1006	-	-	X	-
4	KH2	A	1007	-	-	X	-

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 10942 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 Immune inhibitor A, metalloprotease.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	695	Total	C	N	O	S	Se	0	0	0
			5406	3409	916	1071	1	9			
1	B	689	Total	C	N	O	S	Se	0	0	0
			5357	3381	905	1061	1	9			

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	275	HIS	TYR	conflict	UNP D8H130
A	380	ALA	GLU	engineered mutation	UNP D8H130
A	630	LEU	VAL	conflict	UNP D8H130
A	746	ASN	LYS	conflict	UNP D8H130
A	776	LYS	ASN	conflict	UNP D8H130
A	901	HIS	-	expression tag	UNP D8H130
A	902	HIS	-	expression tag	UNP D8H130
A	903	HIS	-	expression tag	UNP D8H130
A	904	HIS	-	expression tag	UNP D8H130
A	905	HIS	-	expression tag	UNP D8H130
A	906	HIS	-	expression tag	UNP D8H130
B	275	HIS	TYR	conflict	UNP D8H130
B	380	ALA	GLU	engineered mutation	UNP D8H130
B	630	LEU	VAL	conflict	UNP D8H130
B	746	ASN	LYS	conflict	UNP D8H130
B	776	LYS	ASN	conflict	UNP D8H130
B	901	HIS	-	expression tag	UNP D8H130
B	902	HIS	-	expression tag	UNP D8H130
B	903	HIS	-	expression tag	UNP D8H130
B	904	HIS	-	expression tag	UNP D8H130
B	905	HIS	-	expression tag	UNP D8H130
B	906	HIS	-	expression tag	UNP D8H130

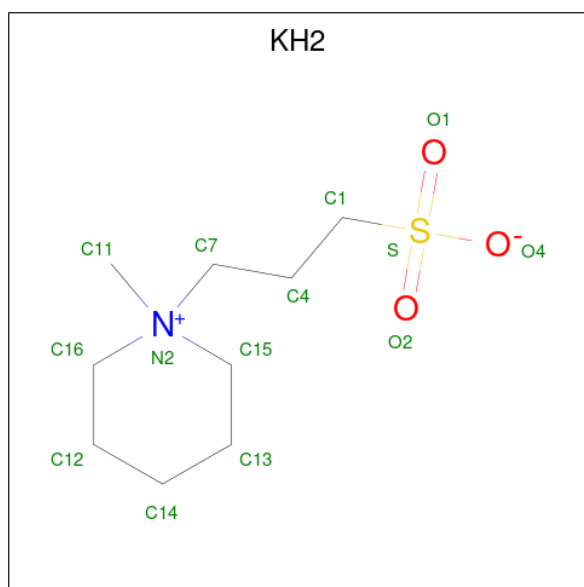
- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Zn	0	0
			1	1		
2	B	1	Total	Zn	0	0
			1	1		

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

- Molecule 4 is 3-(1-methylpiperidinium-1-yl)propane-1-sulfonate (three-letter code: KH2) (formula: C₉H₁₉NO₃S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	S	0	0
			14	9	1	3	1		
4	A	1	Total	C	N	O	S	0	0
			14	9	1	3	1		

- Molecule 5 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			6	3	3		
5	A	1	Total	C	O	0	0
			6	3	3		
5	A	1	Total	C	O	0	0
			6	3	3		
5	A	1	Total	C	O	0	0
			6	3	3		
5	A	1	Total	C	O	0	0
			6	3	3		
5	A	1	Total	C	O	0	0
			6	3	3		

- Molecule 6 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	B	1	Total	K	0	0
			1	1		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	72	Total	O	0	0
			72	72		
7	B	32	Total	O	0	0
			32	32		

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	97.61Å 102.41Å 242.88Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	42.46 – 2.90 42.46 – 2.90	Depositor EDS
% Data completeness (in resolution range)	99.9 (42.46-2.90) 99.8 (42.46-2.90)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.63 (at 2.91Å)	Xtriage
Refinement program	BUSTER 2.11.5	Depositor
R, R_{free}	0.182 , 0.207 0.188 , 0.216	Depositor DCC
R_{free} test set	706 reflections (1.29%)	wwPDB-VP
Wilson B-factor (Å ²)	60.1	Xtriage
Anisotropy	0.721	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 81.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.011 for k,h,-l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	10942	wwPDB-VP
Average B, all atoms (Å ²)	71.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.34% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: CA, ZN, K, KH2, GOL

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	0/5526	0.69	0/7458
1	B	0.51	0/5476	0.69	1/7391 (0.0%)
All	All	0.51	0/11002	0.69	1/14849 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	669	ASN	N-CA-CB	-5.31	101.05	110.60

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	5406	0	5160	42	0
1	B	5357	0	5117	31	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	4	0	0	0	0
3	B	4	0	0	0	0
4	A	28	0	38	16	0
5	A	36	0	48	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	1	0	0	0	0
7	A	72	0	0	1	0
7	B	32	0	0	1	0
All	All	10942	0	10363	80	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 4.

The worst 5 of 80 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:218:THR:HG22	1:A:221:GLN:H	1.24	1.02
1:B:218:THR:HG22	1:B:221:GLN:H	1.34	0.90
1:A:431:ASP:OD1	1:A:435:LYS:HE3	1.76	0.85
1:A:204:GLY:O	1:A:218:THR:HG21	1.82	0.79
1:B:204:GLY:O	1:B:218:THR:HG21	1.83	0.78

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	689/756 (91%)	662 (96%)	25 (4%)	2 (0%)	37	66
1	B	683/756 (90%)	652 (96%)	30 (4%)	1 (0%)	48	77
All	All	1372/1512 (91%)	1314 (96%)	55 (4%)	3 (0%)	44	73

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	597	ALA

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Mol	Chain	Res	Type
1	A	597	ALA
1	A	499	THR

5.3.2 Protein sidechains ⓘ

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	570/617 (92%)	552 (97%)	18 (3%)	34	69
1	B	565/617 (92%)	546 (97%)	19 (3%)	32	67
All	All	1135/1234 (92%)	1098 (97%)	37 (3%)	33	68

5 of 37 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	484	VAL
1	B	710	ASN
1	B	517	LYS
1	B	656	SER
1	A	644	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	50	ASN
1	A	199	GLN
1	B	50	ASN
1	B	199	GLN
1	B	669	ASN

5.3.3 RNA ⓘ

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 19 ligands modelled in this entry, 11 are monoatomic - leaving 8 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$
5	GOL	A	1010	-	5,5,5	0.07	0	5,5,5	0.37	0
5	GOL	A	1009	-	5,5,5	0.14	0	5,5,5	0.39	0
5	GOL	A	1008	-	5,5,5	0.21	0	5,5,5	0.36	0
5	GOL	A	1011	-	5,5,5	0.06	0	5,5,5	0.16	0
5	GOL	A	1013	-	5,5,5	0.35	0	5,5,5	0.44	0
4	KH2	A	1006	-	14,14,14	1.64	3 (21%)	19,20,20	3.04	9 (47%)
4	KH2	A	1007	-	14,14,14	1.70	3 (21%)	19,20,20	2.47	8 (42%)
5	GOL	A	1012	-	5,5,5	0.15	0	5,5,5	0.35	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
5	GOL	A	1010	-	-	4/4/4/4	-
5	GOL	A	1009	-	-	0/4/4/4	-
5	GOL	A	1008	-	-	2/4/4/4	-
5	GOL	A	1011	-	-	2/4/4/4	-
5	GOL	A	1013	-	-	1/4/4/4	-
4	KH2	A	1006	-	-	7/8/18/18	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	KH2	A	1007	-	-	5/8/18/18	0/1/1/1
5	GOL	A	1012	-	-	0/4/4/4	-

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	1006	KH2	O1-S	4.17	1.57	1.45
4	A	1007	KH2	O1-S	3.75	1.56	1.45
4	A	1007	KH2	C1-S	3.57	1.82	1.77
4	A	1007	KH2	O2-S	2.53	1.52	1.45
4	A	1006	KH2	O2-S	2.33	1.51	1.45

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	1006	KH2	C4-C1-S	-7.54	101.69	113.25
4	A	1007	KH2	C11-N2-C16	-5.08	93.61	110.06
4	A	1006	KH2	C11-N2-C7	-4.63	94.04	109.34
4	A	1007	KH2	O4-S-C1	4.54	113.10	105.77
4	A	1006	KH2	C13-C15-N2	4.42	118.17	112.58

There are no chirality outliers.

5 of 21 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	1006	KH2	C4-C1-S-O1
4	A	1006	KH2	C4-C7-N2-C11
4	A	1006	KH2	C1-C4-C7-N2
4	A	1007	KH2	C4-C7-N2-C16
4	A	1007	KH2	C1-C4-C7-N2

There are no ring outliers.

3 monomers are involved in 17 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	1006	KH2	14	0
4	A	1007	KH2	7	0
5	A	1012	GOL	1	0

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	686/756 (90%)	-0.22	10 (1%) 71 66	34, 62, 102, 143	0
1	B	680/756 (89%)	0.02	21 (3%) 51 46	36, 74, 120, 147	0
All	All	1366/1512 (90%)	-0.10	31 (2%) 61 54	34, 67, 116, 147	0

The worst 5 of 31 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	561	GLN	4.0
1	B	741	THR	3.6
1	B	503	ASP	3.4
1	B	69	PRO	3.3
1	B	341	ILE	3.3

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](#)

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, 95th 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(\AA^2)	Q<0.9
5	GOL	A	1008	6/6	0.64	0.28	102,103,105,105	0
5	GOL	A	1009	6/6	0.73	0.23	101,102,105,106	0
5	GOL	A	1013	6/6	0.77	0.20	79,85,88,89	0
5	GOL	A	1011	6/6	0.79	0.19	88,90,95,98	0
5	GOL	A	1012	6/6	0.86	0.21	94,97,99,101	0
3	CA	B	1005	1/1	0.86	0.10	130,130,130,130	0
5	GOL	A	1010	6/6	0.89	0.19	69,73,75,77	0
4	KH2	A	1007	14/14	0.90	0.16	39,52,89,90	0
6	K	B	1006	1/1	0.91	0.12	78,78,78,78	0
4	KH2	A	1006	14/14	0.93	0.14	32,45,80,81	0
3	CA	A	1005	1/1	0.95	0.09	115,115,115,115	0
3	CA	B	1003	1/1	0.98	0.07	112,112,112,112	0
2	ZN	B	1001	1/1	0.99	0.09	72,72,72,72	0
3	CA	B	1004	1/1	0.99	0.06	103,103,103,103	0
3	CA	A	1002	1/1	0.99	0.07	52,52,52,52	0
3	CA	A	1003	1/1	0.99	0.06	87,87,87,87	0
2	ZN	A	1001	1/1	0.99	0.06	54,54,54,54	0
3	CA	B	1002	1/1	0.99	0.05	61,61,61,61	0
3	CA	A	1004	1/1	1.00	0.02	67,67,67,67	0

6.5 Other polymers [i](#)

There are no such residues in this entry.