Full wwPDB X-ray Structure Validation Report ⓘ

Mar 19, 2025 – 10:50 AM EDT

PDB ID : 1Q5P
Title : S156E/S166D variant of Bacillus lentus subtilisin
Authors : Bott, R.R.; Chan, G.; Domingo, B.; Ganshaw, G.; Hsia, C.Y.; Knapp, M.; Murray, C.J.
Deposited on : 2003-08-08
Resolution : 1.60 Å(reported)

The following versions of software and data (see references ⓘ) were used in the production of this report:

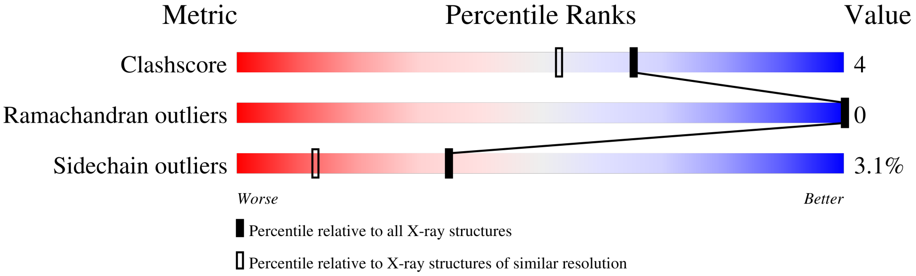
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.41.4

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 1.60 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))
Clashscore	180529	4682 (1.60-1.60)
Ramachandran outliers	177936	4583 (1.60-1.60)
Sidechain outliers	177891	4582 (1.60-1.60)

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%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	269	

2 Entry composition

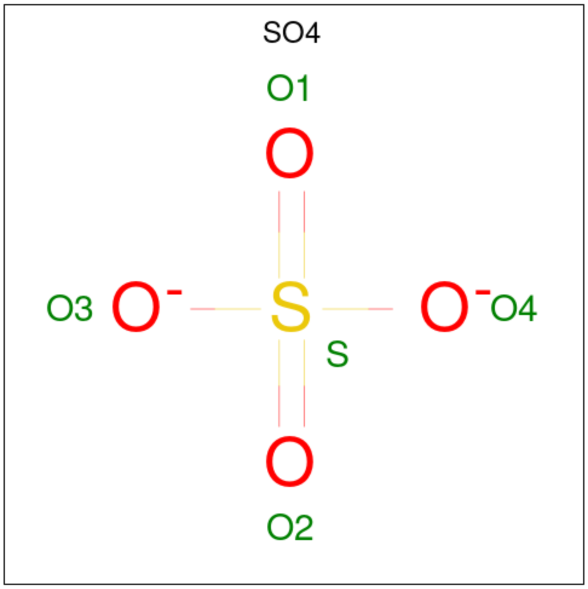
There are 4 unique types of molecules in this entry. The entry contains 2005 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Serine protease.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	269	1895	1161	346	384	4	0	0	0

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
2	A	1	5	4	1	0	0

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

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

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	103	103	103	0	0

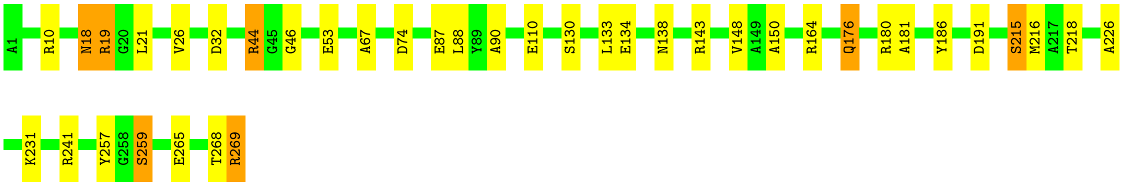
3 Residue-property plots ⓘ

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. 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. 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.

Note EDS was not executed.

- Molecule 1: Serine protease

Chain A:



4 Data and refinement statistics ⓘ

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	53.45Å 61.50Å 75.30Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 1.60	Depositor
% Data completeness (in resolution range)	(Not available) (10.00-1.60)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.06	Depositor
Refinement program	PROLSQ	Depositor
R, R_{free}	0.168 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2005	wwPDB-VP
Average B, all atoms (Å^2)	0.0	wwPDB-VP

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CA, SEB, SO4

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	0.87	1/1912 (0.1%)	1.79	31/2610 (1.2%)

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	A	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	134	GLU	CD-OE1	-5.46	1.19	1.25

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	180	ARG	NE-CZ-NH1	25.73	133.16	120.30
1	A	19	ARG	CD-NE-CZ	22.05	154.47	123.60
1	A	19	ARG	NE-CZ-NH2	-18.88	110.86	120.30
1	A	44	ARG	NE-CZ-NH2	-13.36	113.62	120.30
1	A	241	ARG	NE-CZ-NH1	-9.33	115.63	120.30
1	A	74	ASP	CB-CG-OD1	9.13	126.52	118.30
1	A	269	ARG	NE-CZ-NH1	9.13	124.86	120.30
1	A	164	ARG	NE-CZ-NH1	8.83	124.71	120.30
1	A	180	ARG	NH1-CZ-NH2	-8.71	109.82	119.40
1	A	265	GLU	OE1-CD-OE2	-8.18	113.48	123.30
1	A	143	ARG	NE-CZ-NH1	7.91	124.25	120.30
1	A	10	ARG	NE-CZ-NH1	7.90	124.25	120.30

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	10	ARG	NE-CZ-NH2	7.70	124.15	120.30
1	A	87	GLU	OE1-CD-OE2	7.32	132.08	123.30
1	A	191	ASP	CB-CG-OD2	7.13	124.72	118.30
1	A	10	ARG	NH1-CZ-NH2	-7.12	111.57	119.40
1	A	19	ARG	NH1-CZ-NH2	6.87	126.96	119.40
1	A	180	ARG	NE-CZ-NH2	-6.63	116.99	120.30
1	A	18	ASN	CB-CG-ND2	6.50	132.29	116.70
1	A	181	ALA	CB-CA-C	6.03	119.15	110.10
1	A	186	TYR	CB-CG-CD1	-5.96	117.43	121.00
1	A	257	TYR	CB-CG-CD2	5.63	124.38	121.00
1	A	18	ASN	CB-CG-OD1	-5.52	110.56	121.60
1	A	259	SER	CA-CB-OG	-5.38	96.68	111.20
1	A	87	GLU	CG-CD-OE2	-5.35	107.59	118.30
1	A	32	ASP	CB-CG-OD1	5.33	123.10	118.30
1	A	186	TYR	CB-CG-CD2	5.29	124.17	121.00
1	A	265	GLU	CG-CD-OE1	5.24	128.78	118.30
1	A	53	GLU	CG-CD-OE1	5.18	128.66	118.30
1	A	138	ASN	CB-CG-OD1	-5.04	111.52	121.60
1	A	269	ARG	NE-CZ-NH2	-5.01	117.79	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	269	ARG	Sidechain

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	1895	0	1843	14	0
2	A	5	0	0	0	0
3	A	2	0	0	0	0
4	A	103	0	0	2	0
All	All	2005	0	1843	14	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.

All (14) 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:215:SEB:HJ	4:A:339:HOH:O	1.27	1.29
1:A:176:GLN:HE21	1:A:176:GLN:H	1.26	0.83
1:A:215:SEB:OG	1:A:215:SEB:HH1	1.80	0.78
1:A:176:GLN:H	1:A:176:GLN:NE2	1.94	0.61
1:A:130:SER:HB3	1:A:133:LEU:HB3	1.84	0.59
1:A:148:VAL:HG12	1:A:218:THR:HG23	1.85	0.58
1:A:150:ALA:HB3	1:A:215:SEB:HI1	1.87	0.56
1:A:215:SEB:CJ	4:A:339:HOH:O	2.12	0.51
1:A:21:LEU:CD1	1:A:268:THR:HB	2.41	0.49
1:A:231:LYS:HE3	1:A:268:THR:O	2.12	0.49
1:A:26:VAL:HG11	1:A:226:ALA:HA	1.97	0.47
1:A:46:GLY:HA3	1:A:90:ALA:O	2.15	0.45
1:A:44:ARG:HH21	1:A:44:ARG:HD2	1.41	0.43
1:A:67:ALA:HB1	1:A:88:LEU:HD21	2.00	0.43

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	266/269 (99%)	258 (97%)	8 (3%)	0	100 100

There are no Ramachandran outliers to report.

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	192/192 (100%)	186 (97%)	6 (3%)	35	13

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

Mol	Chain	Res	Type
1	A	18	ASN
1	A	19	ARG
1	A	110	GLU
1	A	176	GLN
1	A	216	MET
1	A	259	SER

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	107	GLN
1	A	138	ASN
1	A	167	ASN
1	A	176	GLN
1	A	200	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is modelled in this entry.

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	$\#\|Z\| > 2$
1	SEB	A	215	1	15,16,17	1.67	1 (6%)	16,21,23	4.65	12 (75%)

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
1	SEB	A	215	1	-	3/10/13/15	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	215	SEB	CJ-CI2	5.00	1.49	1.38

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	215	SEB	CE-CZ-CH1	-7.27	111.79	120.56
1	A	215	SEB	CI1-CJ-CI2	7.22	129.75	119.87
1	A	215	SEB	CH1-CZ-CH2	7.19	128.92	118.23
1	A	215	SEB	OG-CB-CA	7.06	116.27	107.63
1	A	215	SEB	CJ-CI2-CH2	-5.36	113.62	120.24
1	A	215	SEB	CJ-CI1-CH1	-5.15	113.88	120.24
1	A	215	SEB	CB-OG-SD	-4.97	108.60	119.30
1	A	215	SEB	OD2-SD-CE	-4.38	99.04	108.71
1	A	215	SEB	OG-SD-CE	3.57	114.01	104.18
1	A	215	SEB	CI2-CH2-CZ	-3.37	115.87	120.61
1	A	215	SEB	OD1-SD-CE	2.77	114.82	108.71
1	A	215	SEB	CI1-CH1-CZ	-2.11	117.65	120.61

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	215	SEB	SD-CE-CZ-CH1
1	A	215	SEB	CB-OG-SD-OD1
1	A	215	SEB	SD-CE-CZ-CH2

There are no ring outliers.

1 monomer is involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	215	SEB	4	0

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 3 ligands modelled in this entry, 2 are monoatomic - leaving 1 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	$\#\|Z\| > 2$
2	SO4	A	270	-	4,4,4	0.77	0	6,6,6	0.19	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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 (i)

6.1 Protein, DNA and RNA chains (i)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates (i)

EDS was not executed - this section is therefore empty.

6.4 Ligands (i)

EDS was not executed - this section is therefore empty.

6.5 Other polymers (i)

EDS was not executed - this section is therefore empty.