



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:40 PM UTC

PDB ID : 1SCD / pdb_00001scd
Title : X-RAY CRYSTAL STRUCTURE OF CROSS-LINKED SUBTILISM
CARLSBERG IN WATER VS. ACETONITRILE
Authors : Fitzpatrick, P.A.; Ringe, D.; Klivanov, A.M.
Deposited on : 1993-08-23
Resolution : 2.30 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 ⓘ 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 : 4-5-2 with Phenix2.0
Xtriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

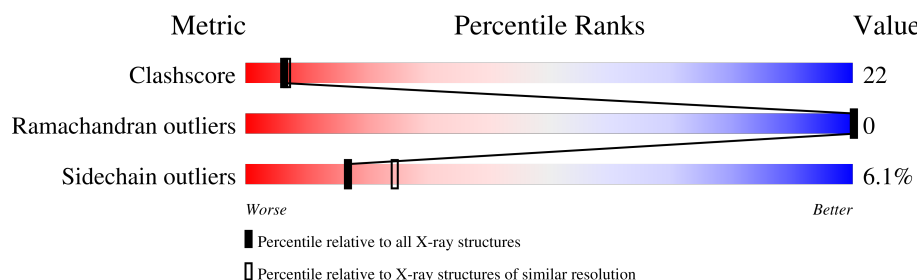
1 Overall quality at a glance

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))
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	274	 64% 30% 5%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2036 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 SUBTILISIN CARLSBERG.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	274	Total	C	N	O	S	0	0	0
			1920	1190	332	393	5			

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	103	SER	THR	conflict	UNP P00780
A	129	ALA	PRO	conflict	UNP P00780
A	158	ASN	SER	conflict	UNP P00780
A	161	SER	ASN	conflict	UNP P00780
A	212	ASN	SER	conflict	UNP P00780

- Molecule 2 is CALCIUM ION (CCD ID: CA) (formula: Ca).

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

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	114	Total	O	0	0
			114	114		

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: SUBTILISIN CARLSBERG



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	77.20Å 55.80Å 53.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 2.30	Depositor
% Data completeness (in resolution range)	(Not available) (10.00-2.30)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	PROLSQ	Depositor
R, R_{free}	0.146 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2036	wwPDB-VP
Average B, all atoms (Å ²)	14.0	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

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	1.28	4/1951 (0.2%)	2.13	53/2659 (2.0%)

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 (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	211	THR	N-CA	-9.11	1.34	1.46
1	A	193	GLY	N-CA	6.82	1.52	1.45
1	A	166	GLY	N-CA	5.47	1.48	1.44
1	A	200	ALA	N-CA	5.36	1.51	1.46

All (53) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	210	PRO	CA-C-N	24.16	167.68	121.54
1	A	210	PRO	C-N-CA	24.16	167.68	121.54
1	A	73	ALA	N-CA-C	8.34	123.06	111.56
1	A	8	ILE	CA-C-N	8.21	127.80	118.85
1	A	8	ILE	C-N-CA	8.21	127.80	118.85
1	A	8	ILE	CA-C-O	8.05	124.09	118.69
1	A	248	ASN	CA-CB-CG	-8.04	104.56	112.60
1	A	7	GLY	CA-C-N	7.77	126.55	120.33
1	A	7	GLY	C-N-CA	7.77	126.55	120.33

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	210	PRO	CA-C-O	7.57	129.33	121.23
1	A	97	ASN	CA-C-N	7.46	130.60	120.38
1	A	97	ASN	C-N-CA	7.46	130.60	120.38
1	A	255	THR	CA-CB-OG1	-7.38	98.53	109.60
1	A	210	PRO	N-CA-CB	7.21	109.76	103.27
1	A	73	ALA	CA-C-O	-7.10	112.15	120.53
1	A	211	THR	CA-CB-OG1	-7.02	99.08	109.60
1	A	211	THR	N-CA-CB	6.90	122.15	110.49
1	A	78	THR	N-CA-CB	-6.85	99.89	111.20
1	A	60	ASP	CA-CB-CG	6.77	119.37	112.60
1	A	131	GLY	N-CA-C	-6.58	103.32	112.13
1	A	181	ASP	CA-CB-CG	6.47	119.08	112.60
1	A	113	TRP	N-CA-C	-6.43	104.19	111.07
1	A	185	ASN	CA-CB-CG	6.42	119.02	112.60
1	A	200	ALA	CA-C-N	5.91	126.83	119.98
1	A	200	ALA	C-N-CA	5.91	126.83	119.98
1	A	50	PHE	CA-CB-CG	-5.87	107.93	113.80
1	A	197	GLU	CB-CG-CD	5.86	122.57	112.60
1	A	113	TRP	O-C-N	5.69	127.93	122.07
1	A	224	SER	CA-C-O	5.60	123.78	118.63
1	A	224	SER	CA-C-N	5.58	125.42	119.28
1	A	224	SER	C-N-CA	5.58	125.42	119.28
1	A	116	THR	CA-CB-OG1	-5.48	101.38	109.60
1	A	172	ASP	CB-CA-C	5.47	120.50	110.11
1	A	235	LEU	CA-C-O	-5.43	114.80	120.55
1	A	39	HIS	CA-C-N	5.42	125.09	119.56
1	A	39	HIS	C-N-CA	5.42	125.09	119.56
1	A	104	TYR	N-CA-CB	5.39	118.04	110.12
1	A	79	THR	CA-C-N	5.37	128.71	120.07
1	A	79	THR	C-N-CA	5.37	128.71	120.07
1	A	200	ALA	CB-CA-C	5.33	117.26	110.76
1	A	79	THR	CA-CB-OG1	-5.32	101.62	109.60
1	A	108	VAL	CB-CA-C	5.27	118.94	112.04
1	A	216	THR	O-C-N	5.20	129.43	123.29
1	A	128	GLY	CA-C-N	5.18	127.64	120.29
1	A	128	GLY	C-N-CA	5.18	127.64	120.29
1	A	125	SER	N-CA-CB	5.15	116.12	110.35
1	A	219	GLY	N-CA-C	5.15	118.62	111.00
1	A	179	ALA	CA-C-N	5.15	131.07	122.57
1	A	179	ALA	C-N-CA	5.15	131.07	122.57
1	A	58	ASN	N-CA-C	5.12	118.56	112.72
1	A	189	PHE	CA-CB-CG	5.10	118.90	113.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	263	TYR	N-CA-C	5.08	120.58	113.02
1	A	78	THR	CA-CB-CG2	5.03	119.05	110.50

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	210	PRO	Peptide

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	1920	0	1878	84	0
2	A	2	0	0	0	0
3	A	114	0	0	8	0
All	All	2036	0	1878	84	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 22.

All (84) 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:55:ALA:C	1:A:57:TYR:N	2.01	1.19
1:A:35:ILE:HD12	1:A:92:ALA:HB2	1.47	0.95
1:A:158:ASN:HD22	1:A:158:ASN:H	1.20	0.85
1:A:55:ALA:CA	1:A:57:TYR:N	2.41	0.84
1:A:25:ASN:N	3:A:564:HOH:O	1.79	0.81
1:A:242:SER:H	1:A:245:GLN:HE21	1.30	0.79
1:A:230:ALA:HB1	1:A:270:VAL:CG1	2.15	0.77
1:A:15:LYS:HE3	1:A:271:GLU:OE2	1.85	0.77
1:A:68:VAL:HG13	1:A:225:PRO:HG3	1.68	0.76
1:A:158:ASN:HD22	1:A:158:ASN:N	1.84	0.76
1:A:15:LYS:HE2	3:A:540:HOH:O	1.85	0.75

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:158:ASN:H	1:A:158:ASN:ND2	1.82	0.74
1:A:97:ASN:HD22	1:A:97:ASN:C	1.95	0.74
1:A:62:ASN:HD22	1:A:64:HIS:H	1.35	0.74
1:A:265:LYS:HB3	1:A:265:LYS:NZ	2.02	0.74
1:A:63:GLY:HA2	1:A:210:PRO:HG3	1.72	0.70
1:A:265:LYS:HB3	1:A:265:LYS:HZ3	1.57	0.68
1:A:26:VAL:O	1:A:88:VAL:HG23	1.94	0.68
1:A:127:GLY:HA2	1:A:167:TYR:O	1.95	0.67
1:A:11:ILE:O	1:A:270:VAL:HG22	1.96	0.66
1:A:230:ALA:HB1	1:A:270:VAL:HG12	1.76	0.66
1:A:28:VAL:HG23	1:A:88:VAL:HG21	1.77	0.66
1:A:163:ASN:C	1:A:163:ASN:HD22	2.05	0.63
1:A:230:ALA:CB	1:A:270:VAL:HG11	2.28	0.63
1:A:35:ILE:HD12	1:A:92:ALA:CB	2.25	0.61
1:A:24:ALA:O	1:A:25:ASN:HB3	2.00	0.61
1:A:55:ALA:O	1:A:57:TYR:N	2.31	0.61
1:A:163:ASN:OD1	1:A:195:GLU:OE1	2.19	0.61
1:A:242:SER:H	1:A:245:GLN:NE2	1.97	0.60
1:A:6:TYR:O	1:A:9:PRO:HD2	2.01	0.60
1:A:163:ASN:ND2	1:A:165:ILE:H	2.00	0.59
1:A:224:SER:HB3	1:A:225:PRO:HD3	1.84	0.58
1:A:238:HIS:HE1	1:A:274:ALA:O	1.86	0.58
1:A:24:ALA:O	1:A:25:ASN:CB	2.50	0.58
1:A:8:ILE:HB	1:A:9:PRO:HD3	1.85	0.57
1:A:156:SER:HB3	1:A:164:THR:HB	1.87	0.57
1:A:230:ALA:HB1	1:A:270:VAL:HG11	1.83	0.57
1:A:97:ASN:C	1:A:97:ASN:ND2	2.64	0.55
1:A:15:LYS:CE	1:A:271:GLU:OE2	2.54	0.54
1:A:36:GLN:OE1	1:A:212:ASN:ND2	2.41	0.54
1:A:55:ALA:HA	1:A:57:TYR:N	2.22	0.54
1:A:36:GLN:HE22	1:A:212:ASN:H	1.55	0.53
1:A:179:ALA:HA	1:A:200:ALA:O	2.09	0.53
1:A:25:ASN:HB2	3:A:572:HOH:O	2.09	0.51
1:A:58:ASN:HD22	1:A:58:ASN:H	1.58	0.51
1:A:34:GLY:C	1:A:35:ILE:HG13	2.35	0.51
1:A:2:GLN:HE22	1:A:77:ASN:H	1.59	0.51
1:A:28:VAL:CG2	1:A:88:VAL:HG21	2.41	0.51
1:A:141:ASN:ND2	3:A:578:HOH:O	2.44	0.50
1:A:63:GLY:HA2	1:A:210:PRO:CG	2.40	0.50
1:A:251:SER:HB2	1:A:265:LYS:HG3	1.94	0.50
1:A:8:ILE:CD1	1:A:8:ILE:N	2.75	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:97:ASN:ND2	1:A:101:SER:H	2.12	0.48
1:A:200:ALA:HB1	1:A:201:PRO:CD	2.44	0.47
1:A:230:ALA:CB	1:A:270:VAL:CG1	2.85	0.47
1:A:22:LYS:HE3	1:A:86:PRO:HG2	1.95	0.47
1:A:8:ILE:N	1:A:8:ILE:HD12	2.30	0.47
1:A:158:ASN:HB3	1:A:192:VAL:HG11	1.97	0.46
1:A:6:TYR:C	1:A:6:TYR:CD1	2.94	0.46
1:A:126:LEU:C	1:A:126:LEU:HD12	2.41	0.46
1:A:240:ASN:H	1:A:240:ASN:HD22	1.64	0.46
1:A:14:ASP:OD1	3:A:547:HOH:O	2.20	0.46
1:A:89:SER:HA	3:A:570:HOH:O	2.16	0.45
1:A:62:ASN:HB2	1:A:98:SER:O	2.17	0.45
1:A:104:TYR:OH	3:A:531:HOH:O	2.07	0.45
1:A:213:THR:C	1:A:214:TYR:CD1	2.95	0.45
1:A:224:SER:N	1:A:225:PRO:HD2	2.31	0.45
1:A:224:SER:N	1:A:225:PRO:CD	2.80	0.44
1:A:142:ALA:O	1:A:147:VAL:HG23	2.17	0.44
1:A:214:TYR:CD1	1:A:214:TYR:N	2.86	0.44
1:A:104:TYR:HD1	1:A:135:MET:CE	2.32	0.43
1:A:104:TYR:HD1	1:A:135:MET:HE3	1.84	0.43
1:A:156:SER:HB2	1:A:191:SER:OG	2.19	0.43
1:A:209:TYR:CG	1:A:210:PRO:HD2	2.53	0.43
1:A:22:LYS:NZ	1:A:76:ASP:OD2	2.48	0.42
1:A:19:GLN:HE22	1:A:237:LYS:NZ	2.17	0.42
1:A:26:VAL:O	1:A:88:VAL:CG2	2.66	0.41
1:A:88:VAL:HG22	1:A:89:SER:N	2.36	0.41
1:A:28:VAL:HG23	1:A:88:VAL:CG2	2.50	0.41
1:A:158:ASN:HB3	1:A:192:VAL:CG1	2.50	0.41
1:A:94:LYS:NZ	3:A:554:HOH:O	2.54	0.41
1:A:8:ILE:CB	1:A:9:PRO:HD3	2.49	0.40
1:A:240:ASN:H	1:A:240:ASN:ND2	2.18	0.40
1:A:108:VAL:HG22	1:A:135:MET:HA	2.02	0.40

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	270/274 (98%)	261 (97%)	9 (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	198/198 (100%)	186 (94%)	12 (6%)	17	24

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	54	GLU
1	A	58	ASN
1	A	78	THR
1	A	97	ASN
1	A	98	SER
1	A	156	SER
1	A	158	ASN
1	A	163	ASN
1	A	211	THR
1	A	217	LEU
1	A	240	ASN
1	A	265	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	19	GLN
1	A	36	GLN

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Mol	Chain	Res	Type
1	A	58	ASN
1	A	62	ASN
1	A	97	ASN
1	A	137	GLN
1	A	141	ASN
1	A	158	ASN
1	A	163	ASN
1	A	212	ASN
1	A	238	HIS
1	A	240	ASN
1	A	245	GLN

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 ⓘ

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

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

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	55:ALA	C	57:TYR	N	2.01

6 Fit of model and data

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.