



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 04:40 AM UTC

PDB ID : 1TON / pdb_00001ton
Title : RAT SUBMAXILLARY GLAND SERINE PROTEASE, TONIN. STRUCTURE SOLUTION AND REFINEMENT AT 1.8 ANGSTROMS RESOLUTION
Authors : Fujinaga, M.; James, M.N.G.
Deposited on : 1987-06-03
Resolution : 1.80 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

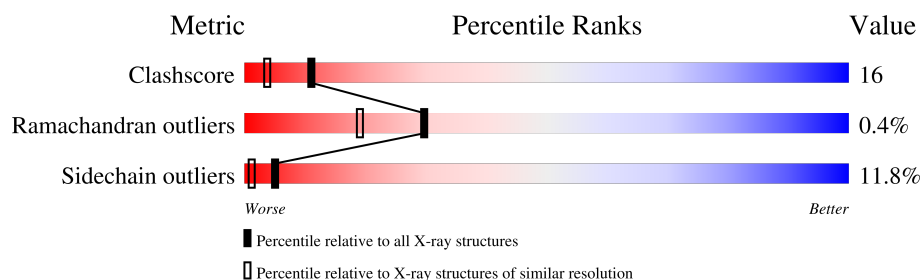
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 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	8479 (1.80-1.80)
Ramachandran outliers	187476	8391 (1.80-1.80)
Sidechain outliers	187428	8390 (1.80-1.80)

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	235	 52% 33% 11% ..

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 1884 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 TONIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	228	Total	C	N	O	S	8	0	1
			1734	1094	296	329	15			

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn).

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

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	149	Total	O	0	0
			149	149		

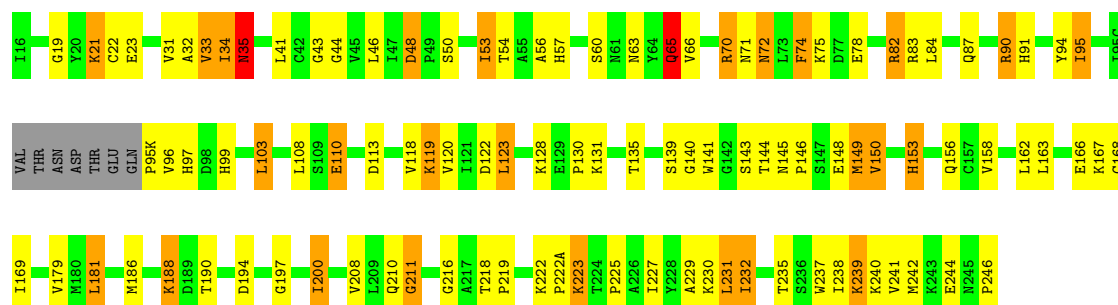
3 Residue-property plots

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: TONIN

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 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	48.58Å 48.58Å 200.20Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 1.80	Depositor
% Data completeness (in resolution range)	(Not available) (8.00-1.80)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	PROLSQ	Depositor
R, R_{free}	0.196 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	1884	wwPDB-VP
Average B, all atoms (Å ²)	16.0	wwPDB-VP

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: ZN

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	1.31	4/1773 (0.2%)	1.91	46/2407 (1.9%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	19	GLY	N-CA	6.22	1.49	1.44
1	A	95(K)	PRO	CB-CG	6.13	1.80	1.49
1	A	211	GLY	N-CA	5.80	1.50	1.45
1	A	197	GLY	N-CA	5.37	1.51	1.44

All (46) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	95(K)	PRO	N-CA-CB	8.28	112.11	103.00
1	A	48	ASP	O-C-N	7.70	127.83	121.83
1	A	43	GLY	N-CA-C	-7.26	100.09	112.51
1	A	96	VAL	CA-C-O	7.22	129.26	120.74
1	A	123	LEU	CB-CA-C	7.00	120.53	109.27
1	A	190	THR	N-CA-C	-6.89	100.32	110.52
1	A	148	GLU	CA-CB-CG	6.68	127.46	114.10
1	A	95(K)	PRO	CA-CB-CG	-6.47	92.20	104.50
1	A	91	HIS	CA-CB-CG	-6.17	107.63	113.80
1	A	179	VAL	N-CA-C	6.04	117.29	111.91
1	A	150	VAL	O-C-N	6.03	129.45	122.99
1	A	143	SER	CA-C-O	5.99	127.49	120.96
1	A	232	ILE	CB-CA-C	5.97	120.77	112.05
1	A	140	GLY	O-C-N	5.85	130.34	123.61
1	A	149	MET	N-CA-C	5.79	117.64	108.67
1	A	113	ASP	N-CA-CB	5.74	118.85	109.95
1	A	34	ILE	CA-C-O	5.60	126.94	120.67

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	145	ASN	CA-CB-CG	-5.59	107.01	112.60
1	A	96	VAL	CA-C-N	5.59	128.78	120.95
1	A	96	VAL	C-N-CA	5.59	128.78	120.95
1	A	71	ASN	N-CA-C	-5.53	104.56	112.13
1	A	95	ILE	CB-CA-C	-5.51	104.84	111.18
1	A	22	CYS	CA-C-O	-5.46	115.61	121.56
1	A	135	THR	CA-CB-OG1	-5.45	101.43	109.60
1	A	72	ASN	CA-CB-CG	-5.45	107.16	112.60
1	A	188	LYS	CG-CD-CE	5.41	123.75	111.30
1	A	231	LEU	O-C-N	5.41	127.86	122.12
1	A	122	ASP	O-C-N	5.34	128.92	122.94
1	A	194	ASP	CA-C-O	-5.34	112.83	119.18
1	A	35	ASN	CA-CB-CG	5.29	117.89	112.60
1	A	33	VAL	O-C-N	5.28	129.28	123.10
1	A	153	HIS	CA-CB-CG	-5.21	108.59	113.80
1	A	144	THR	CA-CB-OG1	-5.20	101.80	109.60
1	A	181	LEU	N-CA-C	-5.19	101.65	109.85
1	A	108	LEU	CA-C-N	5.17	127.53	120.54
1	A	108	LEU	C-N-CA	5.17	127.53	120.54
1	A	41	LEU	N-CA-C	-5.13	100.88	109.24
1	A	200	ILE	CA-C-N	-5.13	115.93	123.00
1	A	200	ILE	C-N-CA	-5.13	115.93	123.00
1	A	91	HIS	CA-C-N	5.11	125.14	119.32
1	A	91	HIS	C-N-CA	5.11	125.14	119.32
1	A	65	GLN	N-CA-CB	5.07	118.72	110.77
1	A	65	GLN	CA-C-N	-5.06	116.54	123.12
1	A	65	GLN	C-N-CA	-5.06	116.54	123.12
1	A	166	GLU	CA-CB-CG	5.03	124.17	114.10
1	A	218	THR	N-CA-C	-5.00	103.73	109.93

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	1734	0	1711	56	0
2	A	1	0	0	0	0
3	A	149	0	0	6	0
All	All	1884	0	1711	56	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 16.

All (56) 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:131:LYS:HD2	3:A:373:HOH:O	1.75	0.86
1:A:216:GLY:HA3	3:A:343:HOH:O	1.96	0.65
1:A:130:PRO:HB2	1:A:162:LEU:CD2	2.27	0.65
1:A:123:LEU:HD22	1:A:235:THR:HG22	1.79	0.62
1:A:238:ILE:HG22	1:A:242:MET:HE2	1.83	0.61
1:A:70:ARG:HD2	3:A:297:HOH:O	2.01	0.60
1:A:74:PHE:CD1	1:A:74:PHE:N	2.68	0.60
1:A:244:GLU:C	1:A:246:PRO:HD3	2.26	0.60
1:A:167:LYS:HB3	1:A:186:MET:HE1	1.84	0.60
1:A:83:ARG:HD2	1:A:110:GLU:O	2.03	0.59
1:A:35:ASN:HB3	1:A:63:ASN:O	2.02	0.59
1:A:72:ASN:HB3	1:A:75:LYS:HB2	1.85	0.58
1:A:200:ILE:HA	1:A:208:VAL:O	2.03	0.58
1:A:21:LYS:HG2	1:A:156:GLN:HE22	1.70	0.57
1:A:167:LYS:HE2	3:A:358:HOH:O	2.05	0.55
1:A:238:ILE:CG2	1:A:242:MET:HE2	2.37	0.55
1:A:70:ARG:NH2	1:A:75:LYS:O	2.39	0.55
1:A:56:ALA:HB1	1:A:90:ARG:HG2	1.89	0.54
1:A:130:PRO:HB2	1:A:162:LEU:HD21	1.90	0.53
1:A:230:LYS:HG2	1:A:232:ILE:HG22	1.91	0.53
1:A:118:VAL:C	1:A:119:LYS:HG2	2.35	0.51
1:A:66:VAL:O	1:A:82:ARG:HA	2.11	0.51
1:A:82:ARG:HD2	1:A:82:ARG:C	2.36	0.50
1:A:139:SER:HA	1:A:156:GLN:O	2.12	0.48
1:A:53:ILE:HD11	1:A:103:LEU:CD2	2.44	0.47
1:A:74:PHE:HE1	1:A:153:HIS:HA	1.80	0.46
1:A:94:TYR:OH	1:A:97:HIS:HE1	1.99	0.46
1:A:74:PHE:CE1	1:A:153:HIS:CG	3.04	0.46
1:A:239:LYS:HB3	3:A:366:HOH:O	2.15	0.46
1:A:158:VAL:HG21	1:A:188:LYS:HB3	1.99	0.45
1:A:46:LEU:HD11	1:A:48:ASP:O	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:146:PRO:O	1:A:219:PRO:HA	2.17	0.44
1:A:35:ASN:ND2	1:A:60:SER:HB3	2.32	0.44
1:A:74:PHE:CE1	1:A:153:HIS:HA	2.52	0.44
1:A:211:GLY:HA2	1:A:229:ALA:O	2.19	0.43
1:A:33:VAL:C	1:A:34:ILE:HG13	2.43	0.43
1:A:31:VAL:HG22	1:A:44:GLY:C	2.44	0.43
1:A:32:ALA:HB2	1:A:141:TRP:CZ3	2.54	0.43
1:A:95:ILE:HG23	3:A:323:HOH:O	2.18	0.43
1:A:74:PHE:CZ	1:A:153:HIS:CE1	3.07	0.43
1:A:103:LEU:CD1	1:A:229:ALA:HB1	2.49	0.43
1:A:163:LEU:HD12	1:A:225:PRO:CG	2.49	0.43
1:A:169:ILE:HD12	1:A:169:ILE:HA	1.93	0.43
1:A:181:LEU:HD21	1:A:230:LYS:HG3	1.99	0.42
1:A:210:GLN:O	1:A:231:LEU:HB2	2.19	0.42
1:A:237:TRP:O	1:A:241:VAL:HG23	2.19	0.42
1:A:168:CYS:HB3	1:A:227:ILE:HD11	2.01	0.41
1:A:84:LEU:HD23	1:A:84:LEU:HA	1.89	0.41
1:A:231:LEU:HD23	1:A:231:LEU:HA	1.87	0.41
1:A:235:THR:O	1:A:239:LYS:HB2	2.20	0.41
1:A:53:ILE:HG13	1:A:54:THR:N	2.35	0.41
1:A:65:GLN:HE22	1:A:82:ARG:CZ	2.34	0.41
1:A:57:HIS:HE1	1:A:99:HIS:CD2	2.39	0.41
1:A:65:GLN:HE21	1:A:65:GLN:HA	1.86	0.40
1:A:186:MET:O	1:A:223:LYS:N	2.45	0.40
1:A:74:PHE:N	1:A:74:PHE:HD1	2.17	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	224/235 (95%)	218 (97%)	5 (2%)	1 (0%)	30 19

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	35	ASN

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	195/203 (96%)	172 (88%)	23 (12%)	5 1

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	LYS
1	A	23	GLU
1	A	50	SER
1	A	53	ILE
1	A	65	GLN
1	A	70	ARG
1	A	74	PHE
1	A	78	GLU
1	A	82	ARG
1	A	87	GLN
1	A	90	ARG
1	A	103	LEU
1	A	110	GLU
1	A	119	LYS
1	A	120	VAL
1	A	128	LYS
1	A	149	MET
1	A	150	VAL
1	A	222	LYS
1	A	222(A)	PRO
1	A	223	LYS
1	A	239	LYS
1	A	240	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	65	GLN
1	A	156	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 1 ligands modelled in this entry, 1 is 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 [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

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.