



Full wwPDB Geometry-Only Validation Report ⓘ

Mar 4, 2026 – 08:07 PM UTC

PDB ID : 1NTP / pdb_00001ntp
Title : USE OF THE NEUTRON DIFFRACTION H/D EXCHANGE TECHNIQUE
TO DETERMINE THE CONFORMATIONAL DYNAMICS OF TRYPSIN
Authors : Kossiakoff, A.A.
Deposited on : 1987-09-16
Resolution : 1.80 Å(reported)

This is a Full wwPDB Geometry-Only 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
Mogul	:	2022.3.0, CSD as543be (2022)
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

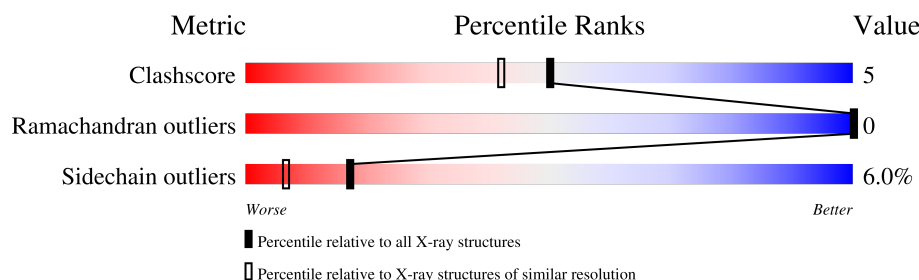
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

NEUTRON 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	223	 62% 30% 7%

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 3230 atoms, of which 1440 are hydrogens and 154 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.

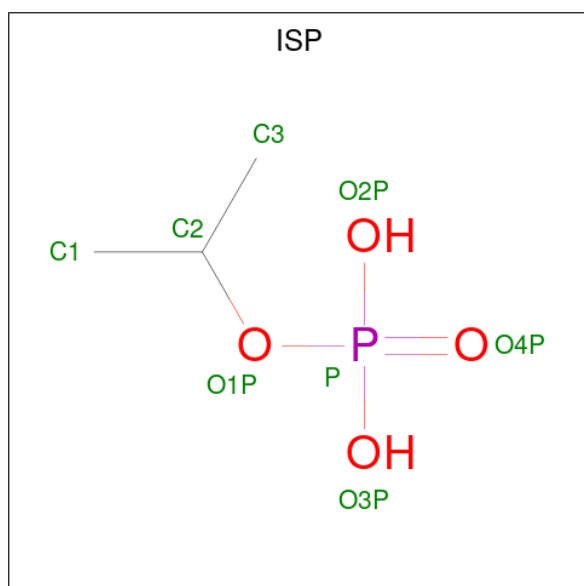
- Molecule 1 is a protein called BETA-TRYPSIN.

Mol	Chain	Residues	Atoms							ZeroOcc	AltConf	Trace
			Total	C	D	H	N	O	S			
1	A	223	3216	1012	154	1433	276	327	14	69	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	48	ASP	ASN	conflict	UNP P00760
A	95	ASP	ASN	conflict	UNP P00760
A	115	ASP	ASN	conflict	UNP P00760

- Molecule 2 is PHOSPHORYLISOPROPANE (CCD ID: ISP) (formula: $C_3H_9O_4P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	H	O	P		
2	A	1	14	3	7	3	1	0	0

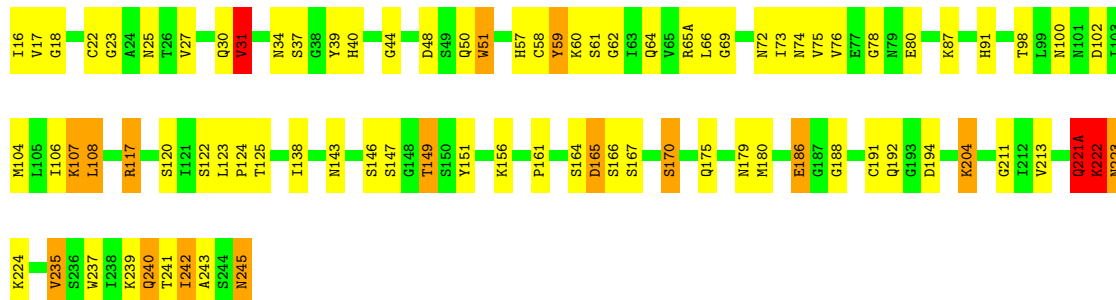
3 Residue-property plots [i](#)

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. 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: BETA-TRYPSIN

Chain A: 



4 Model quality

4.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ISP

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	1.85	16/1660 (1.0%)	2.49	108/2250 (4.8%)

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	2

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	237	TRP	NE1-CE2	-8.38	1.28	1.37
1	A	165	ASP	CA-CB	7.85	1.66	1.53
1	A	73	ILE	N-CA	7.25	1.54	1.46
1	A	51	TRP	NE1-CE2	-7.03	1.29	1.37
1	A	117	ARG	NE-CZ	6.77	1.40	1.33
1	A	240	GLN	CA-CB	6.34	1.63	1.53
1	A	62	GLY	N-CA	6.12	1.54	1.45
1	A	61	SER	CA-CB	5.90	1.62	1.53
1	A	240	GLN	N-CA	5.89	1.53	1.46
1	A	223	ASN	CA-CB	5.81	1.63	1.53
1	A	125	THR	N-CA	5.41	1.53	1.46
1	A	180	MET	C-N	-5.41	1.26	1.33
1	A	164	SER	C-N	-5.38	1.27	1.33
1	A	243	ALA	CA-C	5.21	1.60	1.52
1	A	44	GLY	C-O	5.16	1.28	1.23
1	A	40	HIS	CB-CG	5.13	1.57	1.50

All (108) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	165	ASP	CA-CB-CG	16.48	129.08	112.60
1	A	117	ARG	NE-CZ-NH2	13.44	131.30	119.20
1	A	221(A)	GLN	OE1-CD-NE2	-11.55	111.05	122.60
1	A	117	ARG	NH1-CZ-NH2	-11.45	104.42	119.30
1	A	30	GLN	OE1-CD-NE2	-11.00	111.60	122.60
1	A	192	GLN	CB-CG-CD	10.80	130.96	112.60
1	A	223	ASN	CA-CB-CG	10.65	123.25	112.60
1	A	211	GLY	O-C-N	10.61	133.41	123.65
1	A	245	ASN	OD1-CG-ND2	10.15	132.75	122.60
1	A	164	SER	O-C-N	9.83	134.97	122.87
1	A	50	GLN	CB-CA-C	-8.92	95.46	110.44
1	A	61	SER	O-C-N	-8.67	112.78	123.01
1	A	222	LYS	N-CA-CB	-8.47	96.38	109.34
1	A	123	LEU	CA-C-O	8.47	129.37	120.64
1	A	192	GLN	OE1-CD-NE2	-8.20	114.40	122.60
1	A	243	ALA	N-CA-C	8.15	122.32	112.38
1	A	186	GLU	O-C-N	-7.84	111.64	122.46
1	A	108	LEU	O-C-N	7.81	132.22	123.16
1	A	60	LYS	O-C-N	7.79	131.75	123.42
1	A	186	GLU	CB-CG-CD	7.65	125.60	112.60
1	A	223	ASN	OD1-CG-ND2	7.61	130.21	122.60
1	A	204	LYS	O-C-N	7.59	132.52	122.96
1	A	192	GLN	CG-CD-NE2	7.50	127.65	116.40
1	A	34	ASN	OD1-CG-ND2	-7.46	115.14	122.60
1	A	125	THR	O-C-N	7.41	132.42	122.49
1	A	18	GLY	CA-C-N	7.25	128.88	122.43
1	A	18	GLY	C-N-CA	7.25	128.88	122.43
1	A	91	HIS	O-C-N	-7.10	114.98	121.30
1	A	50	GLN	OE1-CD-NE2	6.95	129.55	122.60
1	A	17	VAL	O-C-N	-6.90	115.62	122.93
1	A	31	VAL	O-C-N	6.83	130.27	122.97
1	A	102	ASP	OD1-CG-OD2	-6.78	106.63	122.90
1	A	165	ASP	N-CA-CB	-6.55	99.10	109.78
1	A	175	GLN	N-CA-C	6.53	122.21	113.72
1	A	72	ASN	CA-CB-CG	-6.50	106.10	112.60
1	A	235	VAL	O-C-N	6.43	128.37	121.94
1	A	104	MET	O-C-N	6.40	130.55	123.25
1	A	61	SER	CB-CA-C	6.40	120.34	109.53
1	A	58	CYS	O-C-N	-6.36	114.19	122.39
1	A	74	ASN	CA-C-O	6.34	126.87	119.32
1	A	164	SER	CA-C-N	6.33	130.32	120.82
1	A	164	SER	C-N-CA	6.33	130.32	120.82
1	A	243	ALA	CA-C-O	6.33	127.15	119.49

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	122	SER	CA-CB-OG	6.29	123.67	111.10
1	A	65(A)	ARG	O-C-N	6.28	130.68	123.27
1	A	221(A)	GLN	CB-CA-C	6.28	119.90	109.53
1	A	241	THR	O-C-N	-6.28	115.30	122.09
1	A	170	SER	N-CA-CB	6.25	120.77	110.39
1	A	40	HIS	CB-CA-C	-6.14	100.07	109.89
1	A	240	GLN	N-CA-CB	6.11	119.21	110.16
1	A	188	GLY	N-CA-C	6.11	123.47	115.40
1	A	237	TRP	O-C-N	6.11	129.12	122.15
1	A	156	LYS	CG-CD-CE	6.09	125.30	111.30
1	A	167	SER	O-C-N	6.05	128.30	122.07
1	A	98	THR	CA-C-O	6.04	126.03	119.15
1	A	149	THR	O-C-N	-6.02	116.04	123.44
1	A	59	TYR	CB-CG-CD1	-5.95	111.88	120.80
1	A	30	GLN	CG-CD-NE2	5.94	125.31	116.40
1	A	161	PRO	N-CA-CB	5.93	109.00	102.72
1	A	179	ASN	CB-CA-C	-5.93	101.16	110.94
1	A	59	TYR	CD1-CG-CD2	5.86	126.88	118.10
1	A	107	LYS	CB-CG-CD	5.78	124.59	111.30
1	A	123	LEU	O-C-N	-5.78	114.30	121.64
1	A	149	THR	N-CA-C	5.72	118.77	108.48
1	A	76	VAL	O-C-N	5.69	129.83	122.77
1	A	235	VAL	N-CA-C	5.69	116.33	110.36
1	A	69	GLY	O-C-N	5.68	129.27	122.34
1	A	149	THR	CB-CA-C	-5.60	100.28	109.80
1	A	138	ILE	CA-C-N	-5.59	113.07	122.29
1	A	138	ILE	C-N-CA	-5.59	113.07	122.29
1	A	75	VAL	O-C-N	5.59	129.25	123.05
1	A	22	CYS	CA-C-O	5.55	126.43	120.55
1	A	143	ASN	OD1-CG-ND2	-5.49	117.11	122.60
1	A	104	MET	N-CA-CB	5.47	120.80	111.66
1	A	78	GLY	CA-C-N	-5.46	113.96	122.37
1	A	78	GLY	C-N-CA	-5.46	113.96	122.37
1	A	165	ASP	OD1-CG-OD2	-5.42	109.89	122.90
1	A	124	PRO	O-C-N	5.42	129.73	123.06
1	A	100	ASN	O-C-N	5.42	129.50	122.89
1	A	64	GLN	OE1-CD-NE2	-5.38	117.22	122.60
1	A	37	SER	N-CA-C	-5.35	99.41	110.80
1	A	175	GLN	N-CA-CB	-5.34	102.80	110.65
1	A	27	VAL	O-C-N	-5.31	115.05	121.10
1	A	240	GLN	CB-CG-CD	5.27	121.56	112.60
1	A	80	GLU	OE1-CD-OE2	-5.27	110.25	122.90

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	80	GLU	N-CA-C	5.27	117.92	110.50
1	A	31	VAL	CB-CA-C	-5.25	103.34	110.90
1	A	57	HIS	CA-CB-CG	5.25	119.05	113.80
1	A	221(A)	GLN	CA-C-O	5.24	126.95	120.92
1	A	27	VAL	CA-C-O	5.24	126.97	119.95
1	A	100	ASN	OD1-CG-ND2	5.23	127.83	122.60
1	A	223	ASN	CB-CG-ND2	-5.21	108.58	116.40
1	A	213	VAL	O-C-N	5.21	128.23	122.66
1	A	48	ASP	CA-CB-CG	5.20	117.80	112.60
1	A	125	THR	CA-C-N	5.19	131.08	121.94
1	A	125	THR	C-N-CA	5.19	131.08	121.94
1	A	125	THR	N-CA-C	5.19	119.88	113.50
1	A	31	VAL	CA-CB-CG1	5.17	119.19	110.40
1	A	147	SER	O-C-N	-5.13	117.27	123.27
1	A	240	GLN	CA-CB-CG	5.11	124.33	114.10
1	A	161	PRO	CB-CA-C	-5.11	102.19	110.21
1	A	120	SER	O-C-N	5.06	128.61	122.94
1	A	240	GLN	O-C-N	5.06	127.92	122.15
1	A	23	GLY	O-C-N	5.04	127.74	122.75
1	A	166	SER	O-C-N	5.04	127.26	122.07
1	A	106	ILE	O-C-N	5.03	128.70	123.26
1	A	124	PRO	N-CA-CB	5.01	107.99	103.33
1	A	191	CYS	N-CA-CB	-5.00	101.85	110.76

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	39	TYR	Sidechain
1	A	59	TYR	Sidechain

4.2 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	1783	1433	1581	17	0
2	A	7	7	7	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	1790	1440	1588	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 5.

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:221(A):GLN:HE21	1:A:224:LYS:HG3	1.54	0.63
1:A:222:LYS:O	1:A:223:ASN:HB2	2.01	0.54
1:A:221(A):GLN:CD	1:A:222:LYS:HZ1	2.13	0.51
1:A:221(A):GLN:CG	1:A:222:LYS:HE2	2.39	0.48
1:A:221(A):GLN:CD	1:A:222:LYS:HE2	2.34	0.47
1:A:16:ILE:N	1:A:194:ASP:OD2	2.46	0.47
1:A:51:TRP:CD2	1:A:242:ILE:HG22	2.44	0.47
1:A:221(A):GLN:CD	1:A:222:LYS:CE	2.89	0.46
1:A:149:THR:CG2	1:A:151:TYR:CE1	2.99	0.45
1:A:107:LYS:HE2	1:A:245:ASN:O	2.11	0.45
1:A:25:ASN:OD1	1:A:117:ARG:NH2	2.48	0.45
1:A:31:VAL:HG12	1:A:66:LEU:CD2	2.43	0.44
1:A:51:TRP:CE2	1:A:242:ILE:HG22	2.48	0.43
1:A:221(A):GLN:HG3	1:A:222:LYS:HE2	1.91	0.43
1:A:235:VAL:HG12	1:A:239:LYS:CD	2.45	0.41
1:A:235:VAL:CG1	1:A:239:LYS:HD2	2.46	0.41
1:A:107:LYS:HG3	1:A:108:LEU:N	2.31	0.41

There are no symmetry-related clashes.

4.3 Torsion angles [i](#)

4.3.1 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	221/223 (99%)	212 (96%)	9 (4%)	0	100	100

There are no Ramachandran outliers to report.

4.3.2 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	184/184 (100%)	173 (94%)	11 (6%)	17	7

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	31	VAL
1	A	87	LYS
1	A	146	SER
1	A	165	ASP
1	A	170	SER
1	A	186	GLU
1	A	204	LYS
1	A	221(A)	GLN
1	A	222	LYS
1	A	240	GLN
1	A	242	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

4.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

4.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

4.6 Ligand geometry [i](#)

1 ligand 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	$\# Z > 2$
2	ISP	A	1	-	3,6,7	0.81	0	3,7,10	1.96	1 (33%)

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
2	ISP	A	1	-	-	1/2/4/5	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1	ISP	O1P-C2-C1	3.07	118.32	107.72

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1	ISP	C1-C2-O1P-P

There are no ring outliers.

No monomer is involved in short contacts.

4.7 Other polymers [i](#)

There are no such residues in this entry.

4.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.