Full wwPDB X-ray Structure Validation Report ⓘ

Jun 5, 2020 – 06:22 pm BST

PDB ID	:	2BDY
Title	:	thrombin in complex with inhibitor
Authors	:	Xue, Y.
Deposited on	:	2005-10-21
Resolution	:	1.61 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 following versions of software and data (see references ⓘ) were used in the production of this report:

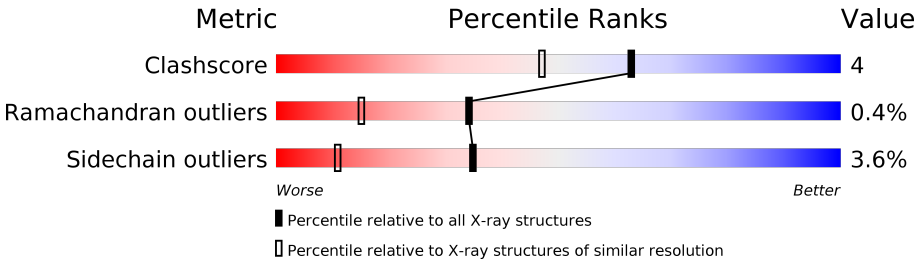
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 1.61 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	141614	5002 (1.64-1.60)
Ramachandran outliers	138981	4888 (1.64-1.60)
Sidechain outliers	138945	4887 (1.64-1.60)

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 on 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	289	84% 9%
2	B	10	90% 10%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 2719 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 Thrombin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	276	Total	C	N	O	S	0	0	0
			2236	1423	393	405	15			

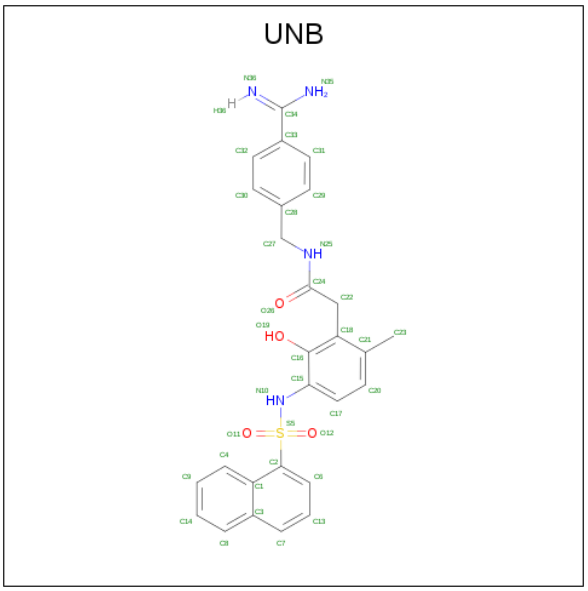
- Molecule 2 is a protein called Hirudin IIIB'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	10	Total	C	N	O	S	0	0	0
			89	56	10	22	1			

- Molecule 3 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Na	0	0
			1	1		

- Molecule 4 is N-(4-CARBAMIMIDOYL-BENZYL)-2-[2-HYDROXY-6-METHYL-3-(NAPHTHALENE-1-SULFONYLAMINO)-PHENYL]-ACETAMIDE (three-letter code: UNB) (formula: $C_{27}H_{26}N_4O_4S$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	S	0	0
			36	27	4	4	1		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	356	Total	O	0	0
			356	356		
5	B	1	Total	O	0	0
			1	1		

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA 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: Thrombin

Chain A:

- Molecule 2: Hirudin IIIB'

Chain B:

4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	69.92Å 71.65Å 71.23Å 90.00° 99.56° 90.00°	Depositor
Resolution (Å)	70.71 – 1.61	Depositor
% Data completeness (in resolution range)	97.8 (70.71-1.61)	Depositor
R_{merge}	0.13	Depositor
R_{sym}	0.13	Depositor
Refinement program	REFMAC	Depositor
R, R_{free}	0.193 , 0.225	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2719	wwPDB-VP
Average B, all atoms (Å^2)	24.0	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: NA, UNB, TYS

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	0.59	0/2289	0.80	6/3088 (0.2%)
2	B	0.42	0/73	0.81	0/96
All	All	0.58	0/2362	0.80	6/3184 (0.2%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	205	ASP	CB-CG-OD2	6.38	124.05	118.30
1	A	22	ASP	CB-CG-OD2	6.22	123.90	118.30
1	A	285	ASP	CB-CG-OD2	5.92	123.63	118.30
1	A	149	ASP	CB-CG-OD2	5.75	123.47	118.30
1	A	133	ASP	CB-CG-OD2	5.18	122.96	118.30
1	A	229	ASP	CB-CG-OD2	5.04	122.83	118.30

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	2236	0	2214	19	0
2	B	89	0	68	1	0
3	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	A	36	0	24	1	0
5	A	356	0	0	2	0
5	B	1	0	0	0	0
All	All	2719	0	2306	20	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 (20) 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:58:SER:OG	1:A:59:PRO:CD	2.25	0.85
1:A:58:SER:OG	1:A:59:PRO:HD2	1.82	0.80
1:A:106:ARG:HG3	1:A:107:TYR:N	2.02	0.74
1:A:89:ASN:ND2	5:A:597:HOH:O	2.34	0.60
1:A:58:SER:OG	1:A:59:PRO:HD3	2.04	0.58
1:A:51:GLN:NE2	1:A:175:THR:OG1	2.38	0.56
1:A:54:LEU:CD2	1:A:97:VAL:HG12	2.38	0.54
1:A:95:LEU:HD11	1:A:117:LEU:HD11	1.93	0.51
1:A:106:ARG:HD2	2:B:357:GLU:OE1	2.12	0.50
1:A:58:SER:CB	1:A:59:PRO:CD	2.90	0.48
1:A:54:LEU:HD22	1:A:97:VAL:HG12	1.96	0.46
1:A:106:ARG:HG3	1:A:107:TYR:O	2.15	0.46
1:A:253:GLY:HA2	1:A:271:THR:O	2.16	0.45
1:A:247:ASN:ND2	5:A:485:HOH:O	2.49	0.45
1:A:50:TRP:CG	1:A:154:VAL:HB	2.54	0.43
1:A:272:HIS:CG	1:A:275:ARG:HG3	2.54	0.42
1:A:97:VAL:HG13	1:A:117:LEU:HD21	2.01	0.42
4:A:401:UNB:H4	4:A:401:UNB:O11	2.19	0.41
1:A:207:THR:HG21	1:A:211:ILE:HD11	2.03	0.40
1:A:246:ASN:C	1:A:246:ASN:HD22	2.24	0.40

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	270/289 (93%)	260 (96%)	9 (3%)	1 (0%)	34 15
2	B	7/10 (70%)	7 (100%)	0	0	100 100
All	All	277/299 (93%)	267 (96%)	9 (3%)	1 (0%)	34 15

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	58	SER

5.3.2 Protein sidechains (i)

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	243/252 (96%)	234 (96%)	9 (4%)	34 10
2	B	8/9 (89%)	8 (100%)	0	100 100
All	All	251/261 (96%)	242 (96%)	9 (4%)	35 11

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	26	ARG
1	A	95	LEU
1	A	106	ARG
1	A	158	ASP
1	A	186	GLN
1	A	217	CYS
1	A	246	ASN
1	A	275	ARG
1	A	286	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	51	GLN
1	A	186	GLN
1	A	246	ASN
1	A	247	ASN
1	A	251	GLN
1	A	281	GLN
1	A	286	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	$\#\|Z\| > 2$
2	TYS	B	363	2	15,16,17	0.99	2 (13%)	18,22,24	0.96	2 (11%)

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	TYS	B	363	2	-	1/10/11/13	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	363	TYS	OH-CZ	-2.87	1.37	1.42
2	B	363	TYS	OH-S	-2.09	1.55	1.58

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	363	TYS	CG-CB-CA	-2.02	110.01	114.10
2	B	363	TYS	O2-S-O1	2.01	120.30	112.22

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	363	TYS	O-C-CA-CB

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates (i)

There are no carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 2 ligands modelled in this entry, 1 is 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	$\#\|Z\| > 2$
4	UNB	A	401	-	39,39,39	0.74	1 (2%)	52,56,56	1.50	9 (17%)

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
4	UNB	A	401	-	-	3/24/24/24	0/4/4/4

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	401	UNB	C34-N35	2.11	1.39	1.33

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	A	401	UNB	C6-C2-S5	4.70	122.55	116.98
4	A	401	UNB	C28-C27-N25	-4.17	104.11	113.05
4	A	401	UNB	C1-C2-S5	-3.54	117.36	121.58
4	A	401	UNB	O11-S5-C2	2.60	112.67	108.08
4	A	401	UNB	C4-C1-C2	-2.51	120.30	123.60
4	A	401	UNB	C4-C1-C3	2.51	121.13	117.89
4	A	401	UNB	C16-C18-C21	2.34	120.66	117.66
4	A	401	UNB	C17-C20-C21	-2.27	118.53	121.97
4	A	401	UNB	O12-S5-C2	-2.12	104.34	108.08

There are no chirality outliers.

All (3) torsion outliers are listed below:

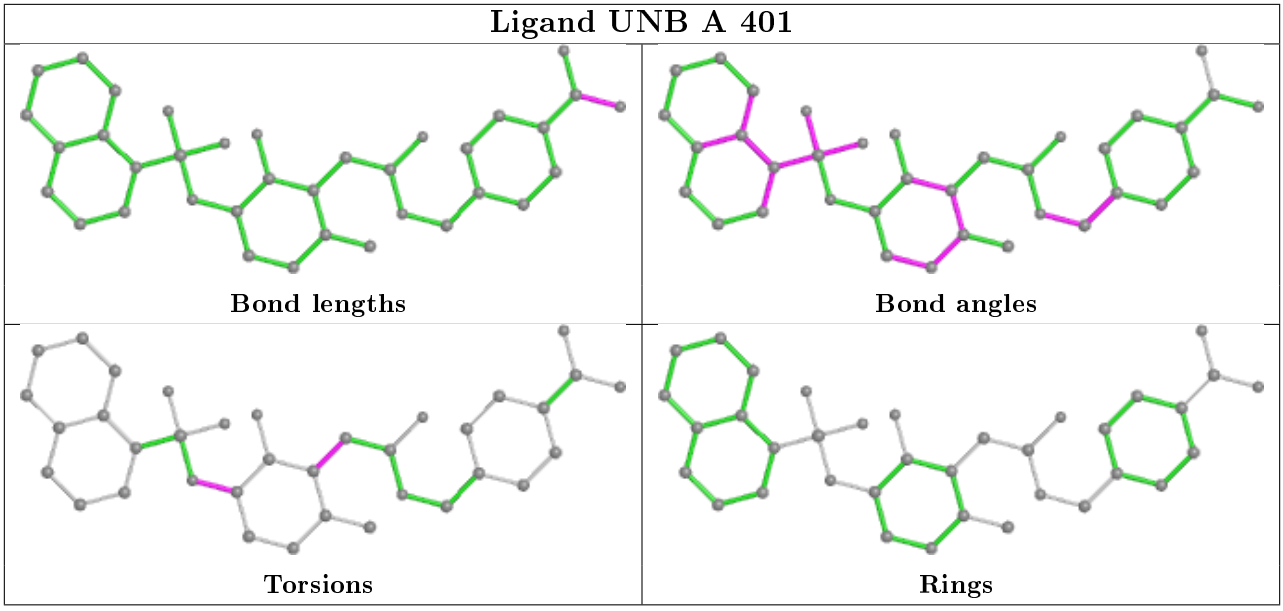
Mol	Chain	Res	Type	Atoms
4	A	401	UNB	C21-C18-C22-C24
4	A	401	UNB	C16-C18-C22-C24
4	A	401	UNB	C16-C15-N10-S5

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	401	UNB	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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

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.