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wwPDB X-ray Structure Validation Summary Report (i)

Oct 5, 2024 – 10:40 AM EDT

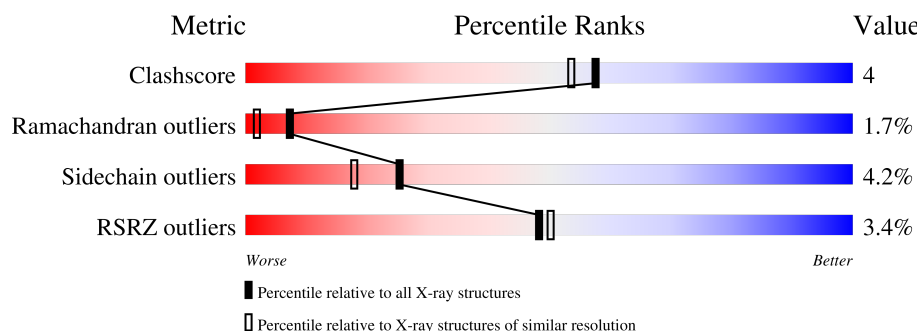|		
PDB ID	:	1C5O
Title	:	STRUCTURAL BASIS FOR SELECTIVITY OF A SMALL MOLECULE, S1-BINDING, SUB-MICROMOLAR INHIBITOR OF UROKINASE TYPE PLASMINOGEN ACTIVATOR
Authors	:	Katz, B.A.; Mackman, R.; Luong, C.; Radika, K.; Martelli, A.; Sprengeler, P.A.; Wang, J.; Chan, H.; Wong, L.
Deposited on	:	1999-12-22
Resolution	:	1.90 Å(reported)

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 1.90 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	Percentile Ranks	Value
Clashscore		4
Ramachandran outliers		1.7%
Sidechain outliers		4.2%
RSRZ outliers		3.4%

Worse — *Better*

▮ Percentile relative to all X-ray structures
◫ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	180529	8090 (1.90-1.90)
Ramachandran outliers	177936	8022 (1.90-1.90)
Sidechain outliers	177891	8022 (1.90-1.90)
RSRZ outliers	164620	7292 (1.90-1.90)

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% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	L	36	22% / 69% 25% 6%
2	H	259	% / 73% 21% •••
3	I	11	82% 18%

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 6121 atoms, of which 3248 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 light chain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	L	36	Total 565	C 177	H 278	N 48	O 61	S 1	26	0	0

- Molecule 2 is a protein called Thrombin heavy chain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	H	252	Total 4071	C 1303	H 2025	N 363	O 366	S 14	2	1	0

- Molecule 3 is a protein called Hirudin.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	I	11	Total 188	C 64	H 84	N 12	O 27	S 1	9	0	0

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	H	1	Total 1	Na 1	0	0

- Molecule 5 is BENZAMIDINE (three-letter code: BEN) (formula: $C_7H_8N_2$).

BEN

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	H	1	Total	C	H	N	0	0
			18	7	9	2		

• Molecule 6 is water.
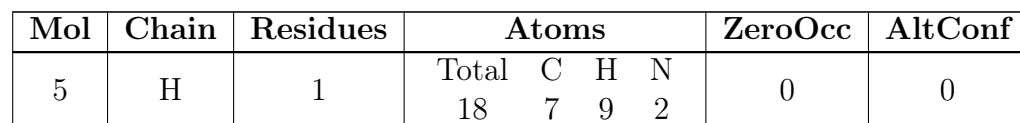
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	L	48	Total	H	O	0	3
			144	96	48		
6	H	369	Total	H	O	0	8
			1107	738	369		
6	I	9	Total	H	O	0	0
			27	18	9		

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). 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.

• Molecule 1: Thrombin light chain

• Molecule 2: Thrombin heavy chain
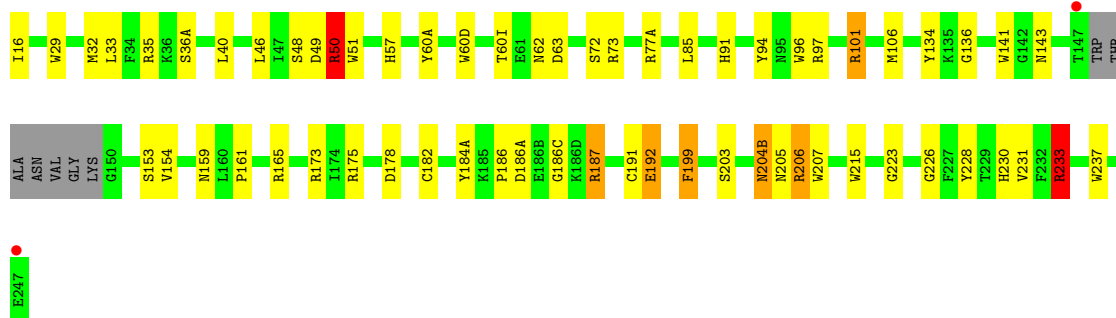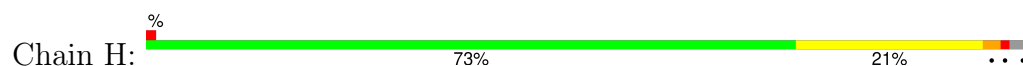
• Molecule 3: Hirudin

4 Data and refinement statistics ⓘ

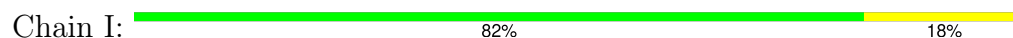| Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants	71.46Å 71.82Å 72.85Å	
a, b, c, α, β, γ	90.00° 100.90° 90.00°	Depositor
Resolution (Å)	7.50 – 1.90	Depositor
	7.50 – 1.90	EDS
% Data completeness	51.0 (7.50-1.90)	Depositor
(in resolution range)	50.1 (7.50-1.90)	EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.47 (at 1.56Å)	Xtriage
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.200 , 0.262	Depositor
	0.205 , (Not available)	DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å^2)	5.5	Xtriage
Anisotropy	0.824	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.28 , 70.1	EDS
L-test for twinning[2]	$< |L| > = 0.46, < L^2 > = 0.28$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.91	EDS
Total number of atoms	6121	wwPDB-VP
Average B, all atoms (Å^2)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.59% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: BEN, NA, 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	L	1.42	0/290	1.51	3/384 (0.8%)
2	H	1.39	5/2102 (0.2%)	1.73	50/2837 (1.8%)
3	I	1.56	0/88	1.34	0/115
All	All	1.40	5/2480 (0.2%)	1.70	53/3336 (1.6%)

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	L	0	1
2	H	0	5
All	All	0	6

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	H	57	HIS	CG-ND1	-5.23	1.27	1.38
2	H	141	TRP	CG-CD2	-5.19	1.34	1.43
2	H	237	TRP	CG-CD2	-5.10	1.34	1.43
2	H	60(D)	TRP	CG-CD2	-5.08	1.35	1.43
2	H	230	HIS	CG-ND1	-5.05	1.27	1.38

The worst 5 of 53 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	H	29	TRP	CD1-NE1-CE2	10.41	118.37	109.00
2	H	186(A)	ASP	CB-CG-OD2	-9.97	109.33	118.30
2	H	141	TRP	CD1-NE1-CE2	9.51	117.56	109.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	H	207	TRP	CD1-NE1-CE2	9.30	117.37	109.00
2	H	51	TRP	CD1-NE1-CE2	9.09	117.18	109.00

There are no chirality outliers.

5 of 6 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	H	175	ARG	Sidechain
2	H	187	ARG	Sidechain
2	H	50	ARG	Sidechain
2	H	97	ARG	Sidechain
1	L	15	ARG	Sidechain

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	L	287	278	278	4	0
2	H	2046	2025	2019	19	0
3	I	104	84	80	1	0
4	H	1	0	0	0	0
5	H	9	9	7	0	0
6	H	369	738	0	0	11
6	I	9	18	0	0	0
6	L	48	96	0	0	2
All	All	2873	3248	2384	21	13

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.

The worst 5 of 21 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:L:1(D):GLY:HA3	1:L:1:CYS:SG	2.27	0.73
2:H:136:GLY:HA3	2:H:199:PHE:CZ	2.41	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:H:161:PRO:HD3	2:H:184(A):TYR:CZ	2.42	0.55
1:L:1(H):THR:HG23	2:H:48:SER:HB3	1.92	0.50
2:H:32:MET:HG3	2:H:40:LEU:HD13	1.95	0.49

The worst 5 of 13 symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:H:425[C]:HOH:O	6:H:425[C]:HOH:O[2_555]	0.72	1.48
6:H:425[C]:HOH:H1	6:H:425[C]:HOH:H2[2_555]	0.39	1.21
6:H:426[C]:HOH:H1	6:H:426[C]:HOH:H1[2_555]	0.45	1.15
6:H:425[C]:HOH:O	6:H:425[C]:HOH:H2[2_555]	0.74	0.86
6:H:462[C]:HOH:H2	6:H:462[C]:HOH:H2[2_555]	0.80	0.80

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	L	34/36 (94%)	24 (71%)	9 (26%)	1 (3%)	3	0
2	H	249/259 (96%)	226 (91%)	19 (8%)	4 (2%)	8	2
3	I	8/11 (73%)	6 (75%)	2 (25%)	0	100	100
All	All	291/306 (95%)	256 (88%)	30 (10%)	5 (2%)	7	2

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	L	1(B)	ALA
2	H	186(C)	GLY
2	H	205	ASN
2	H	62	ASN
2	H	231	VAL

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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	L	31/31 (100%)	27 (87%)	4 (13%)	3	1
2	H	221/225 (98%)	214 (97%)	7 (3%)	34	27
3	I	10/10 (100%)	10 (100%)	0	100	100
All	All	262/266 (98%)	251 (96%)	11 (4%)	25	18

5 of 11 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	H	60(I)	THR
2	H	94	TYR
2	H	204(B)	ASN
2	H	192	GLU
2	H	36(A)	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
2	H	78	ASN
2	H	204(B)	ASN
3	I	65	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	$\#|Z| > 2$
3	TYS	I	63	3	15,16,17	2.96	3 (20%)	15,22,24	0.91	1 (6%)

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
3	TYS	I	63	3	-	0/10/11/13	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	I	63	TYS	OH-S	-10.71	1.37	1.58
3	I	63	TYS	OH-CZ	-2.59	1.38	1.42
3	I	63	TYS	CB-CA	-2.17	1.49	1.53

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	I	63	TYS	OH-S-O2	2.41	114.92	107.56

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 for Mogul analysis.

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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	$\#|Z| > 2$
5	BEN	H	410	-	9,9,9	1.24	1 (11%)	7,11,11	1.41	1 (14%)

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
5	BEN	H	410	-	-	4/4/4/4	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	H	410	BEN	C1-C	-3.43	1.40	1.47

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	H	410	BEN	C5-C6-C1	2.37	122.69	120.36

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	H	410	BEN	N2-C-C1-C2
5	H	410	BEN	N2-C-C1-C6
5	H	410	BEN	N1-C-C1-C2
5	H	410	BEN	N1-C-C1-C6

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 ⓘ

6.1   Protein, DNA and RNA chains ⓘ

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	L	35/36 (97%)	0.41	8 (22%)	2	2	3, 18, 30, 66	11 (31%)
2	H	252/259 (97%)	-0.63	2 (0%)	82	84	3, 16, 35, 47	25 (9%)
3	I	10/11 (90%)	0.07	0	100	100	11, 31, 36, 40	6 (60%)
All	All	297/306 (97%)	-0.48	10 (3%)	48	50	3, 17, 36, 66	42 (14%)

The worst 5 of 10 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	L	1(D)	GLY	8.4
1	L	14(M)	GLY	4.3
2	H	247	GLU	4.2
1	L	1(F)	GLY	3.6
1	L	15	ARG	3.4

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

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	TYS	I	63	16/17	0.95	0.07	39,42,44,45	0

6.3   Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands (i)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
5	BEN	H	410	9/9	0.96	0.04	8,14,16,17	0
4	NA	H	409	1/1	1.00	0.02	7,7,7,7	0

6.5 Other polymers (i)

There are no such residues in this entry.