



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 19, 2024 – 06:44 PM EDT

PDB ID : 2D5W  
Title : The crystal structure of oligopeptide binding protein from *Thermus thermophilus* HB8 complexed with pentapeptide  
Authors : Morita, A.  
Deposited on : 2005-11-07  
Resolution : 1.30 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](mailto: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>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

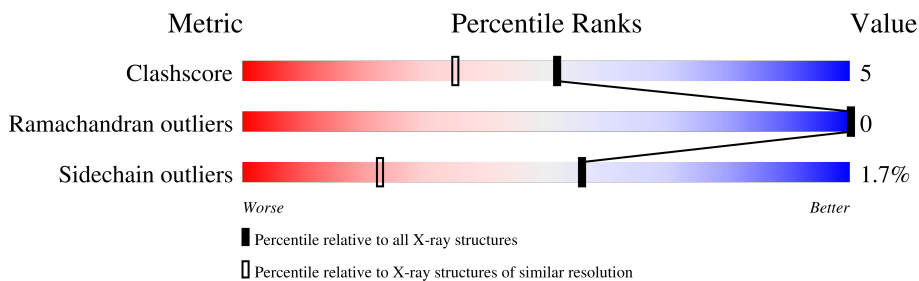
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.30 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	180529	1497 (1.30-1.30)
Ramachandran outliers	177936	1455 (1.30-1.30)
Sidechain outliers	177891	1455 (1.30-1.30)

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  $\geq 3$ , 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	603	<div> <div>91%</div> <div>9%</div> </div>
1	B	603	<div> <div>90%</div> <div>9%</div> </div>
2	C	5	<div> <div>40%</div> <div>60%</div> </div>
3	D	5	<div> <div>40%</div> <div>60%</div> </div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 10842 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 peptide ABC transporter, peptide-binding protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	602	Total	C	N	O	S	0	0	0
			4849	3116	844	878	11			
1	B	602	Total	C	N	O	S	0	0	0
			4849	3116	844	878	11			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	initiating methionine	UNP Q5SHU6
B	1	MET	-	initiating methionine	UNP Q5SHU6

- Molecule 2 is a protein called pentapeptide A.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	5	Total	C	N	O	0	0	0
			37	23	7	7			

- Molecule 3 is a protein called pentapeptide B.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	D	5	Total	C	N	O	0	0	0
			37	22	7	8			

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	568	Total	O	0	0
			568	568		
4	B	499	Total	O	0	0
			499	499		
4	C	2	Total	O	0	0
			2	2		

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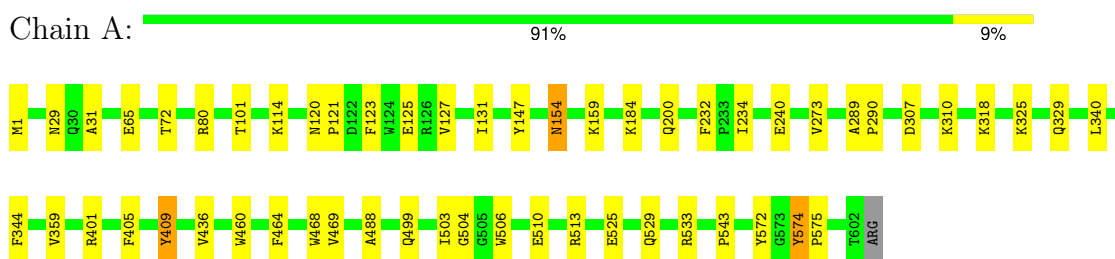
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	D	1	Total	O	0	0
			1	1		

### 3 Residue-property plots

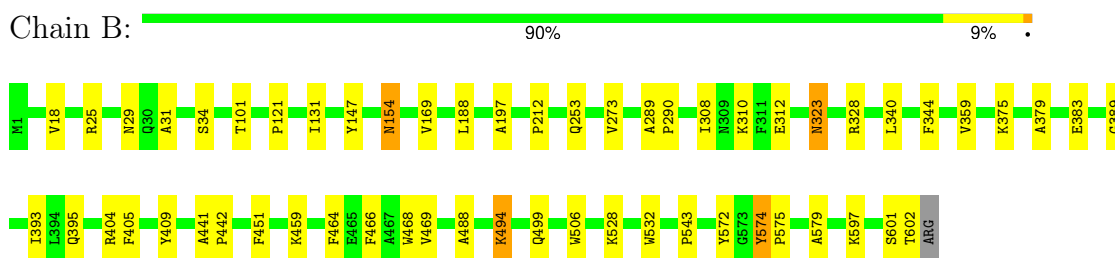
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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.

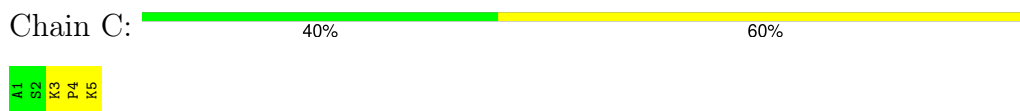
- Molecule 1: peptide ABC transporter, peptide-binding protein



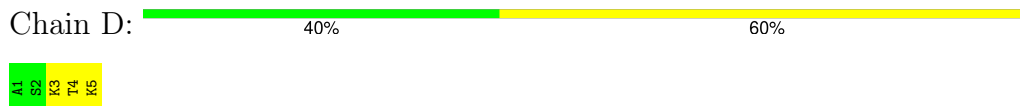
- Molecule 1: peptide ABC transporter, peptide-binding protein



- Molecule 2: pentapeptide A



- Molecule 3: pentapeptide B



## 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 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	100.60Å 109.20Å 114.60Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	15.00 – 1.30	Depositor
% Data completeness (in resolution range)	(Not available) (15.00-1.30)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.10	Depositor
Refinement program	CNS 1.1	Depositor
R, $R_{free}$	0.186 , 0.196	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	10842	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	14.0	wwPDB-VP

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

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	0.30	0/4979	0.59	0/6755
1	B	0.29	0/4979	0.58	0/6755
2	C	0.41	0/37	0.63	0/46
3	D	0.42	0/36	0.54	0/44
All	All	0.30	0/10031	0.59	0/13600

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts [i](#)

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	4849	0	4769	45	0
1	B	4849	0	4769	45	0
2	C	37	0	45	13	0
3	D	37	0	45	15	0
4	A	568	0	0	5	0
4	B	499	0	0	3	0
4	C	2	0	0	0	0
4	D	1	0	0	0	0
All	All	10842	0	9628	97	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 (97) 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:B:574:TYR:HE1	3:D:3:LYS:HZ3	1.15	0.94
1:B:121:PRO:HG3	1:B:499:GLN:HB3	1.62	0.81
1:A:510:GLU:HA	1:A:513:ARG:HH22	1.48	0.79
1:B:34:SER:HB3	3:D:3:LYS:HZ2	1.51	0.76
1:A:114:LYS:HA	1:A:114:LYS:HE2	1.70	0.72
1:A:121:PRO:HG3	1:A:499:GLN:HB3	1.70	0.71
1:A:503:ILE:HD12	1:A:504:GLY:N	2.04	0.71
1:A:120:ASN:HD22	1:A:123:PHE:HB3	1.56	0.70
1:B:312:GLU:HG2	1:B:323:ASN:ND2	2.08	0.69
1:A:510:GLU:HA	1:A:513:ARG:NH2	2.07	0.68
1:B:574:TYR:HE1	3:D:3:LYS:NZ	1.92	0.65
1:B:451:PHE:HA	1:B:459:LYS:HG2	1.80	0.63
1:A:469:VAL:CG2	2:C:5:LYS:HD2	2.28	0.63
1:B:121:PRO:CG	1:B:499:GLN:HB3	2.28	0.63
1:A:572:TYR:CG	2:C:3:LYS:HE3	2.34	0.62
1:A:121:PRO:CG	1:A:499:GLN:HB3	2.29	0.62
1:B:34:SER:HB3	3:D:3:LYS:NZ	2.15	0.61
1:B:359:VAL:HG13	4:B:742:HOH:O	1.99	0.61
1:A:529:GLN:O	1:A:533:ARG:HG2	2.01	0.61
1:A:572:TYR:CD2	2:C:3:LYS:HE3	2.37	0.59
1:A:184:LYS:N	1:A:184:LYS:HD2	2.18	0.59
1:A:460:TRP:CZ2	1:A:503:ILE:HD13	2.38	0.58
1:B:572:TYR:CG	3:D:3:LYS:HE2	2.39	0.57
1:B:310:LYS:O	1:B:323:ASN:ND2	2.37	0.57
1:B:379:ALA:O	1:B:383:GLU:HG3	2.05	0.57
1:A:307:ASP:CG	1:A:503:ILE:HD11	2.25	0.57
1:B:212:PRO:HG3	1:B:579:ALA:HB3	1.86	0.57
1:A:273:VAL:HG22	2:C:5:LYS:HE3	1.86	0.56
1:A:525:GLU:O	1:A:529:GLN:HG3	2.05	0.56
1:B:597:LYS:HB2	1:B:597:LYS:NZ	2.20	0.56
1:B:574:TYR:HB2	1:B:575:PRO:HD2	1.88	0.55
1:A:120:ASN:HD22	1:A:123:PHE:CB	2.18	0.55
1:A:340:LEU:HD21	1:A:344:PHE:CE2	2.42	0.55
1:A:574:TYR:HB2	1:A:575:PRO:HD2	1.87	0.54
1:B:469:VAL:HG21	3:D:5:LYS:HD2	1.89	0.54
1:A:469:VAL:HG21	2:C:5:LYS:HD2	1.90	0.54
2:C:3:LYS:NZ	2:C:3:LYS:HB2	2.23	0.53
1:B:340:LEU:HD21	1:B:344:PHE:CE1	2.43	0.53
1:A:401:ARG:HB2	1:A:401:ARG:NH1	2.23	0.52
1:B:25:ARG:HD3	1:B:29:ASN:ND2	2.23	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:154:ASN:C	1:A:154:ASN:HD22	2.12	0.52
1:B:494:LYS:NZ	1:B:494:LYS:HB2	2.25	0.52
1:A:114:LYS:HE2	1:A:114:LYS:CA	2.40	0.52
1:A:503:ILE:HD12	1:A:503:ILE:C	2.31	0.51
1:B:466:PHE:CE1	3:D:4:THR:HG22	2.46	0.51
1:B:469:VAL:CG2	3:D:5:LYS:HD2	2.41	0.51
2:C:3:LYS:HB2	2:C:3:LYS:HZ2	1.76	0.50
1:A:506:TRP:CG	1:A:543:PRO:HB3	2.48	0.49
1:B:273:VAL:HG22	3:D:5:LYS:HE3	1.93	0.49
1:A:359:VAL:HG13	4:A:879:HOH:O	2.12	0.49
1:B:169:VAL:HG13	1:B:188:LEU:HG	1.95	0.49
1:B:572:TYR:CD2	3:D:3:LYS:HE2	2.47	0.49
1:B:389:GLY:HA3	1:B:395:GLN:HE21	1.78	0.48
2:C:3:LYS:HZ2	2:C:3:LYS:CB	2.25	0.48
1:A:468:TRP:CZ3	2:C:4:PRO:HG3	2.48	0.48
1:B:441:ALA:HB1	1:B:442:PRO:HD2	1.95	0.47
1:B:101:THR:HB	1:B:131:ILE:HD12	1.96	0.47
1:A:325:LYS:O	1:A:329:GLN:HG3	2.15	0.47
1:A:340:LEU:C	1:A:340:LEU:HD13	2.35	0.47
1:B:393:ILE:HB	1:B:404:ARG:HH22	1.80	0.47
1:B:375:LYS:HG3	4:B:997:HOH:O	2.13	0.47
1:A:240:GLU:OE1	1:A:240:GLU:N	2.44	0.47
1:B:468:TRP:CZ3	3:D:4:THR:HG23	2.50	0.47
1:A:125:GLU:HG2	4:A:760:HOH:O	2.15	0.46
1:B:121:PRO:HB2	1:B:488:ALA:HB1	1.96	0.46
1:B:31:ALA:HA	3:D:3:LYS:NZ	2.30	0.46
1:B:289:ALA:N	1:B:290:PRO:CD	2.79	0.46
1:B:308:ILE:HD12	1:B:328:ARG:HD2	1.98	0.46
1:B:340:LEU:C	1:B:340:LEU:HD13	2.36	0.46
1:B:597:LYS:HB2	1:B:597:LYS:HZ2	1.81	0.46
1:B:389:GLY:CA	1:B:395:GLN:HE21	2.30	0.45
4:A:888:HOH:O	2:C:5:LYS:HE2	2.17	0.45
1:B:18:VAL:HB	1:B:197:ALA:HB1	1.98	0.45
1:A:159:LYS:HD2	4:A:870:HOH:O	2.18	0.44
1:A:101:THR:HB	1:A:131:ILE:HD12	1.99	0.44
1:B:31:ALA:HA	3:D:3:LYS:HZ2	1.83	0.44
1:A:232:PHE:CE2	1:A:234:ILE:HB	2.53	0.43
4:B:806:HOH:O	3:D:5:LYS:HE2	2.17	0.43
1:B:601:SER:O	1:B:602:THR:HB	2.18	0.43
1:B:312:GLU:HG2	1:B:323:ASN:HD22	1.81	0.43
1:A:65:GLU:CD	1:A:65:GLU:H	2.22	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:506:TRP:CG	1:B:543:PRO:HB3	2.54	0.43
2:C:3:LYS:HA	2:C:4:PRO:HD3	1.85	0.43
1:B:528:LYS:HE2	1:B:532:TRP:CZ2	2.54	0.42
1:A:409:TYR:HB2	1:A:436:VAL:HG13	2.02	0.42
1:A:310:LYS:HE3	1:A:506:TRP:HB2	2.03	0.41
1:B:154:ASN:C	1:B:154:ASN:HD22	2.23	0.41
1:A:121:PRO:HB2	1:A:488:ALA:HB1	2.02	0.41
1:A:318:LYS:HE2	4:A:1113:HOH:O	2.21	0.41
1:A:460:TRP:HZ2	1:A:503:ILE:HD13	1.82	0.41
3:D:3:LYS:HE3	3:D:3:LYS:HB2	1.71	0.41
1:A:72:THR:OG1	1:A:80:ARG:HB3	2.21	0.41
1:A:31:ALA:HA	2:C:3:LYS:HZ2	1.84	0.41
1:A:29:ASN:O	2:C:4:PRO:HD2	2.22	0.40
1:A:123:PHE:CE1	1:A:127:VAL:HG21	2.56	0.40
1:A:289:ALA:N	1:A:290:PRO:CD	2.84	0.40
1:B:312:GLU:CD	1:B:323:ASN:HD22	2.25	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	600/603 (100%)	579 (96%)	21 (4%)	0	100	100
1	B	600/603 (100%)	578 (96%)	22 (4%)	0	100	100
2	C	3/5 (60%)	3 (100%)	0	0	100	100
3	D	3/5 (60%)	3 (100%)	0	0	100	100
All	All	1206/1216 (99%)	1163 (96%)	43 (4%)	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	505/506 (100%)	497 (98%)	8 (2%)	58	25
1	B	505/506 (100%)	496 (98%)	9 (2%)	54	20
2	C	4/4 (100%)	4 (100%)	0	100	100
3	D	4/4 (100%)	4 (100%)	0	100	100
All	All	1018/1020 (100%)	1001 (98%)	17 (2%)	56	22

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	147	TYR
1	A	154	ASN
1	A	200	GLN
1	A	405	PHE
1	A	409	TYR
1	A	464	PHE
1	A	574	TYR
1	B	147	TYR
1	B	154	ASN
1	B	253	GLN
1	B	323	ASN
1	B	405	PHE
1	B	409	TYR
1	B	464	PHE
1	B	494	LYS
1	B	574	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	154	ASN
1	A	200	GLN

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Mol	Chain	Res	Type
1	A	395	GLN
1	A	399	ASN
1	A	453	GLN
1	B	4	GLN
1	B	29	ASN
1	B	154	ASN
1	B	222	ASN
1	B	231	ASN
1	B	253	GLN
1	B	315	GLN
1	B	323	ASN
1	B	395	GLN
1	B	453	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](#)

There are no ligands in this entry.

### 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.