



Full wwPDB X-ray Structure Validation Report

Feb 26, 2014 – 06:03 PM GMT

PDB ID : 2HSM
Title : Structural basis of yeast aminoacyl-tRNA synthetase complex formation revealed by crystal structures of two binary sub-complexes
Authors : Simader, H.; Suck, D.
Deposited on : 2006-07-22
Resolution : 3.00 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

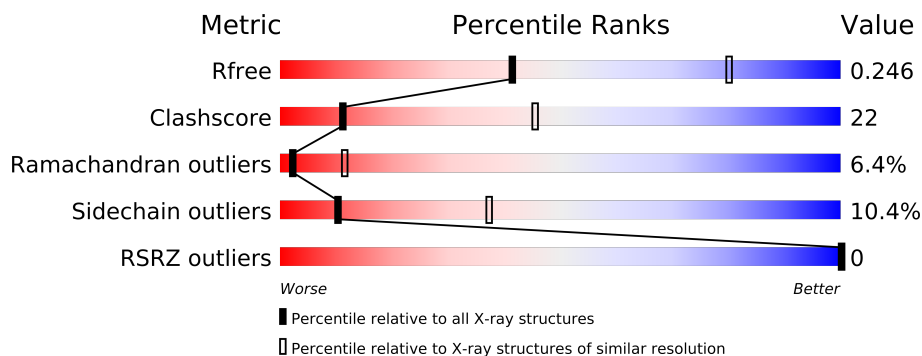
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance

The reported resolution of this entry is 3.00 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))
R_{free}	66092	1216 (3.00-3.00)
Clashscore	79885	1594 (3.00-3.00)
Ramachandran outliers	78287	1537 (3.00-3.00)
Sidechain outliers	78261	1540 (3.00-3.00)
RSRZ outliers	66119	1217 (3.00-3.00)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	207	
2	B	122	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2306 atoms, of which 0 are hydrogen and 0 are deuterium.

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 Glutamyl-tRNA synthetase, cytoplasmic.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	178	Total	C	N	O	S	0	0	0
			1364	873	229	257	5			

- Molecule 2 is a protein called GU4 nucleic-binding protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	121	Total	C	N	O	S	0	0	0
			942	600	156	185	1			

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	41.38Å 87.46Å 52.80Å 90.00° 92.59° 90.00°	Depositor
Resolution (Å)	52.70 – 3.00 45.17 – 3.00	Depositor EDS
% Data completeness (in resolution range)	98.1 (52.70-3.00) 98.1 (45.17-3.00)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.08	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.62 (at 3.01Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.195 , 0.251 0.208 , 0.246	Depositor DCC
R_{free} test set	342 reflections (4.84%)	DCC
Wilson B-factor (Å ²)	57.2	Xtriage
Anisotropy	0.337	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 23.3	EDS
Estimated twinning fraction	0.066 for h,-k,-l	Xtriage
L-test for twinning	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Outliers	0 of 7417 reflections	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	2306	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.09% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

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	0.47	0/1385	0.58	0/1873
2	B	0.48	0/961	0.68	3/1313 (0.2%)
All	All	0.47	0/2346	0.63	3/3186 (0.1%)

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
2	B	0	8
All	All	0	10

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	18	TYR	C-N-CD	-10.84	96.76	120.60
2	B	89	ASP	CB-CG-OD2	5.34	123.10	118.30
2	B	117	ASP	CB-CG-OD2	5.21	122.99	118.30

There are no chirality outliers.

All (10) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	158	ASN	Peptide
1	A	195	ALA	Peptide
2	B	115	SER	Peptide
2	B	116	THR	Peptide
2	B	14	ILE	Peptide
2	B	15	ILE	Peptide

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Mol	Chain	Res	Type	Group
2	B	16	SER	Peptide
2	B	19	PRO	Peptide
2	B	90	VAL	Peptide
2	B	91	LYS	Peptide

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1364	0	1407	40	0
2	B	942	0	895	66	0
All	All	2306	0	2302	103	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 22.

All (103) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:B:15:ILE:HA	2:B:17:LYS:CB	1.46	1.43
2:B:20:VAL:CB	2:B:21:SER:CB	1.98	1.42
2:B:15:ILE:CA	2:B:17:LYS:CB	2.19	1.19
2:B:116:THR:CB	2:B:117:ASP:HB2	1.71	1.18
2:B:20:VAL:CA	2:B:21:SER:CB	2.23	1.16
1:A:195:ALA:HB3	1:A:196:ASN:HD22	0.96	1.11
1:A:195:ALA:HB3	1:A:196:ASN:ND2	1.66	1.10
1:A:156:ILE:HG22	1:A:157:LYS:N	1.58	1.09
2:B:116:THR:CB	2:B:117:ASP:CB	2.30	1.08
1:A:156:ILE:CG2	1:A:157:LYS:H	1.67	1.05
2:B:69:ASP:HB3	2:B:107:MET:CE	1.91	1.00
2:B:18:TYR:CB	2:B:19:PRO:HA	1.90	0.99
2:B:21:SER:O	2:B:22:PHE:HB2	1.63	0.95
1:A:156:ILE:HG22	1:A:157:LYS:H	0.77	0.93
2:B:20:VAL:HA	2:B:21:SER:CB	1.94	0.92
2:B:116:THR:CB	2:B:117:ASP:CG	2.40	0.89
1:A:195:ALA:CB	1:A:196:ASN:HD22	1.83	0.88

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:B:69:ASP:HB3	2:B:107:MET:HE1	1.55	0.86
1:A:195:ALA:CB	1:A:196:ASN:ND2	2.40	0.85
1:A:156:ILE:O	1:A:158:ASN:N	2.10	0.85
2:B:65:PRO:HB3	2:B:107:MET:HE1	1.60	0.84
2:B:87:SER:OG	2:B:90:VAL:CB	2.25	0.84
2:B:14:ILE:O	2:B:17:LYS:CB	2.29	0.81
2:B:69:ASP:HB3	2:B:107:MET:HE3	1.61	0.80
1:A:56:VAL:HG23	1:A:56:VAL:O	1.81	0.79
2:B:19:PRO:C	2:B:20:VAL:O	2.22	0.78
2:B:19:PRO:O	2:B:20:VAL:O	2.03	0.77
2:B:21:SER:O	2:B:22:PHE:CB	2.33	0.76
2:B:116:THR:CA	2:B:117:ASP:HB2	2.16	0.76
2:B:122:ASN:O	2:B:123:HIS:HB2	1.93	0.68
1:A:192:LYS:O	1:A:196:ASN:HB2	1.94	0.67
2:B:15:ILE:HG12	2:B:15:ILE:O	1.91	0.65
2:B:114:SER:O	2:B:116:THR:N	2.30	0.65
2:B:56:ASN:ND2	2:B:61:SER:OG	2.29	0.64
2:B:15:ILE:N	2:B:17:LYS:CB	2.59	0.64
1:A:46:LEU:HD12	1:A:84:ILE:HD13	1.79	0.64
2:B:18:TYR:CB	2:B:19:PRO:CA	2.70	0.62
1:A:158:ASN:CG	1:A:158:ASN:O	2.38	0.62
1:A:55:LEU:HD21	1:A:184:LEU:HD12	1.81	0.62
2:B:15:ILE:C	2:B:17:LYS:CB	2.66	0.62
1:A:56:VAL:CG2	1:A:56:VAL:O	2.51	0.59
2:B:92:SER:O	2:B:93:THR:C	2.41	0.58
1:A:107:LYS:HB3	1:A:151:MET:HE3	1.85	0.58
2:B:23:THR:HG22	2:B:25:GLU:H	1.68	0.57
1:A:195:ALA:O	1:A:196:ASN:C	2.43	0.57
1:A:156:ILE:CG2	1:A:157:LYS:N	2.35	0.57
2:B:34:GLU:HA	2:B:37:LEU:HD12	1.86	0.56
2:B:121:ILE:CG2	2:B:121:ILE:O	2.54	0.56
1:A:104:LEU:HD22	1:A:146:LEU:HD21	1.85	0.56
2:B:56:ASN:OD1	2:B:56:ASN:N	2.40	0.55
2:B:90:VAL:O	2:B:91:LYS:CB	2.54	0.55
2:B:31:ALA:O	2:B:34:GLU:HG3	2.07	0.55
1:A:143:TRP:CZ3	1:A:147:ARG:HG3	2.42	0.55
1:A:133:LEU:HD21	2:B:110:LEU:HD12	1.88	0.54
2:B:81:LYS:NZ	2:B:117:ASP:O	2.33	0.54
1:A:75:ASN:O	1:A:78:THR:HG22	2.08	0.54
2:B:14:ILE:C	2:B:17:LYS:CB	2.76	0.54
2:B:13:LEU:O	2:B:15:ILE:N	2.41	0.53
1:A:125:LEU:HA	2:B:102:ARG:HB3	1.91	0.53

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:B:113:VAL:CG1	2:B:117:ASP:HB3	2.39	0.52
2:B:57:THR:HG22	2:B:58:PHE:CD1	2.45	0.52
2:B:69:ASP:CB	2:B:107:MET:HE1	2.33	0.52
2:B:116:THR:N	2:B:117:ASP:HB2	2.25	0.52
2:B:109:ASN:N	2:B:109:ASN:HD22	2.09	0.51
2:B:15:ILE:O	2:B:15:ILE:CG1	2.58	0.51
2:B:89:ASP:O	2:B:90:VAL:O	2.30	0.50
2:B:13:LEU:O	2:B:16:SER:O	2.30	0.50
1:A:176:ILE:HD12	1:A:176:ILE:H	1.77	0.50
2:B:83:LEU:HD11	2:B:93:THR:HG23	1.93	0.49
1:A:24:THR:HG23	1:A:54:LYS:HB3	1.94	0.49
2:B:54:ARG:HB2	2:B:99:HIS:CD2	2.47	0.49
2:B:43:GLN:HA	2:B:79:LEU:HD21	1.95	0.48
2:B:114:SER:OG	2:B:117:ASP:OD2	2.30	0.47
2:B:81:LYS:HB3	2:B:119:LEU:HD13	1.95	0.47
2:B:83:LEU:HD11	2:B:93:THR:CG2	2.44	0.47
2:B:114:SER:C	2:B:116:THR:N	2.66	0.47
2:B:92:SER:O	2:B:95:THR:N	2.47	0.47
2:B:23:THR:HG22	2:B:24:LYS:N	2.30	0.47
2:B:116:THR:H	2:B:117:ASP:HB2	1.78	0.47
1:A:124:ASN:ND2	1:A:163:ASN:HD21	2.13	0.46
2:B:43:GLN:HB3	2:B:44:PRO:CD	2.45	0.46
1:A:156:ILE:O	1:A:158:ASN:C	2.54	0.45
2:B:80:ILE:O	2:B:84:VAL:HG23	2.16	0.45
1:A:156:ILE:O	1:A:158:ASN:CA	2.63	0.45
2:B:51:LEU:HD12	2:B:54:ARG:NH1	2.31	0.45
1:A:157:LYS:O	1:A:158:ASN:HB3	2.17	0.44
1:A:186:LYS:O	1:A:190:GLU:HG2	2.17	0.44
1:A:149:ASN:HD22	1:A:149:ASN:C	2.21	0.44
1:A:157:LYS:O	1:A:158:ASN:CB	2.65	0.44
1:A:86:ASP:OD1	1:A:87:ASN:N	2.51	0.43
1:A:161:ASP:O	1:A:162:VAL:C	2.56	0.43
2:B:16:SER:HA	2:B:17:LYS:O	2.18	0.43
1:A:55:LEU:HD13	1:A:187:SER:HB3	2.01	0.43
1:A:133:LEU:HD12	2:B:106:TYR:CE1	2.55	0.42
2:B:122:ASN:O	2:B:123:HIS:CB	2.65	0.42
2:B:81:LYS:CB	2:B:119:LEU:HD13	2.50	0.41
2:B:121:ILE:O	2:B:121:ILE:HG22	2.20	0.41
1:A:120:ASP:OD1	1:A:163:ASN:HB2	2.20	0.41
1:A:156:ILE:C	1:A:158:ASN:N	2.68	0.41
1:A:26:ASN:C	1:A:26:ASN:OD1	2.59	0.41
1:A:33:ALA:HB1	1:A:36:GLU:OE2	2.20	0.41

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:89:ASP:O	1:A:90:LYS:C	2.59	0.40
2:B:53:LEU:HD13	2:B:103:TRP:HB2	2.03	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	176/207 (85%)	151 (86%)	20 (11%)	5 (3%)	8	37
2	B	119/122 (98%)	89 (75%)	16 (13%)	14 (12%)	1	2
All	All	295/329 (90%)	240 (81%)	36 (12%)	19 (6%)	2	11

All (19) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	156	ILE
1	A	157	LYS
1	A	158	ASN
1	A	162	VAL
2	B	19	PRO
2	B	20	VAL
2	B	21	SER
2	B	22	PHE
2	B	42	ILE
2	B	17	LYS
2	B	43	GLN
2	B	90	VAL
2	B	118	LYS
2	B	115	SER
1	A	106	ILE
2	B	91	LYS
2	B	120	GLU
2	B	121	ILE

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Mol	Chain	Res	Type
2	B	18	TYR

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	146/173 (84%)	131 (90%)	15 (10%)	10	38
2	B	103/116 (89%)	92 (89%)	11 (11%)	10	35
All	All	249/289 (86%)	223 (90%)	26 (10%)	10	37

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	SER
1	A	57	ASP
1	A	78	THR
1	A	92	GLN
1	A	105	VAL
1	A	147	ARG
1	A	149	ASN
1	A	157	LYS
1	A	158	ASN
1	A	159	LYS
1	A	161	ASP
1	A	169	THR
1	A	186	LYS
1	A	191	LEU
1	A	196	ASN
2	B	13	LEU
2	B	15	ILE
2	B	34	GLU
2	B	54	ARG
2	B	56	ASN
2	B	83	LEU
2	B	102	ARG
2	B	108	GLN
2	B	109	ASN

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Mol	Chain	Res	Type
2	B	118	LYS
2	B	121	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	124	ASN
1	A	149	ASN
1	A	158	ASN
1	A	196	ASN
2	B	29	GLN
2	B	43	GLN
2	B	50	ASN
2	B	56	ASN
2	B	108	GLN
2	B	109	ASN

5.3.3 RNA ⓘ

There are no RNA chains in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

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	A	178/207 (85%)	-0.39	0 100 100	24, 42, 57, 66	0
2	B	121/122 (99%)	-0.38	0 100 100	29, 53, 73, 75	0
All	All	299/329 (90%)	-0.39	0 100 100	24, 45, 71, 75	0

There are no RSRZ outliers to report.

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

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

6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.