Full wwPDB X-ray Structure Validation Report (i)

Sep 20, 2023 – 07:29 PM EDT

PDB ID	:	5HMD
Title	:	Crystal structure of triazine hydrolase variant (Y215H/E241Q)
Authors	:	Sugrue, E.; Carr, P.D.; Jackson, C.J.
Deposited on	:	2016-01-16
Resolution	:	2.10 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 (i) 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 (1)) were used in the production of this report:

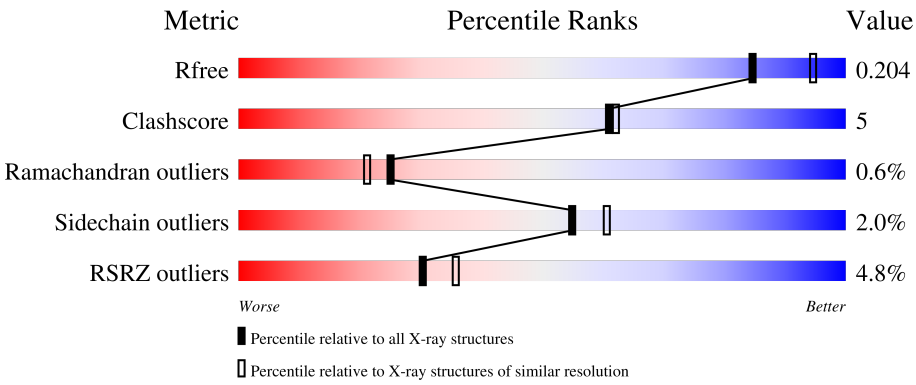
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

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 2.10 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}	130704	5197 (2.10-2.10)
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)
RSRZ outliers	127900	5083 (2.10-2.10)

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	A	458	4% 90% 9% •
1	B	458	5% 89% 8% ••

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 14375 atoms, of which 6882 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 Triazine hydrolase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	456	6974	2219	3456	627	655	17	1	7	0
1	B	455	6919	2203	3426	619	653	18	0	4	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	38	ASN	ASP	conflict	UNP Q6SJY7
A	131	PRO	LEU	conflict	UNP Q6SJY7
A	159	VAL	ALA	conflict	UNP Q6SJY7
A	215	HIS	TYR	conflict	UNP Q6SJY7
A	241	GLN	GLU	conflict	UNP Q6SJY7
A	303	LEU	MET	conflict	UNP Q6SJY7
B	38	ASN	ASP	conflict	UNP Q6SJY7
B	131	PRO	LEU	conflict	UNP Q6SJY7
B	159	VAL	ALA	conflict	UNP Q6SJY7
B	215	HIS	TYR	conflict	UNP Q6SJY7
B	241	GLN	GLU	conflict	UNP Q6SJY7
B	303	LEU	MET	conflict	UNP Q6SJY7

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
2	A	1	1	1	0	0
2	B	1	1	1	0	0

- Molecule 3 is water.

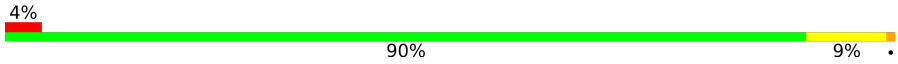
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	274	274	274	0	0
			Total	O		
3	B	206	206	206	0	0

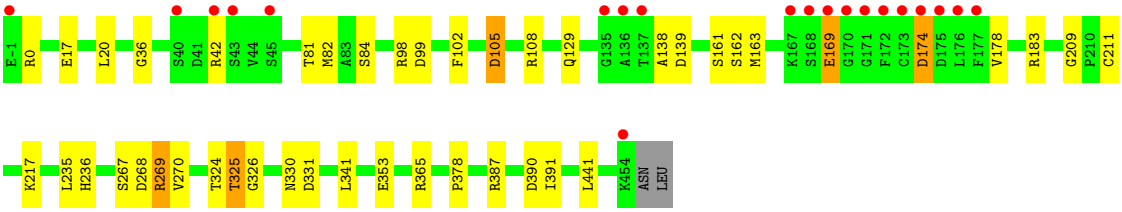
3 Residue-property plots (i)

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 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: Triazine hydrolase

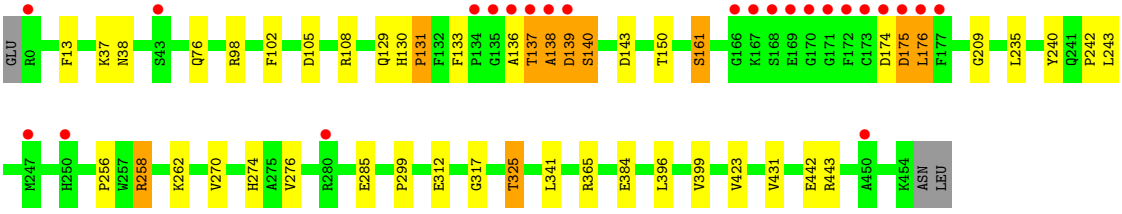
Chain A:





- Molecule 1: Triazine hydrolase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	56.15Å 99.42Å 77.18Å 90.00° 101.12° 90.00°	Depositor
Resolution (Å)	19.68 – 2.10 19.69 – 2.10	Depositor EDS
% Data completeness (in resolution range)	98.6 (19.68-2.10) 91.8 (19.69-2.10)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.00 (at 2.09Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.145 , 0.203 0.154 , 0.204	Depositor DCC
R_{free} test set	2397 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	17.2	Xtriage
Anisotropy	0.643	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.41 , 56.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	14375	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 17.95% of the height of the origin peak. No significant pseudotranslation is detected.*

[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 (i)

5.1 Standard geometry (i)

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

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	0.60	0/3617	0.74	4/4923 (0.1%)
1	B	0.69	0/3575	0.74	2/4868 (0.0%)
All	All	0.65	0/7192	0.74	6/9791 (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
1	B	0	1
All	All	0	3

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	268	ASP	O-C-N	8.41	136.16	122.70
1	B	130	HIS	C-N-CD	-7.15	104.87	120.60
1	B	139	ASP	N-CA-C	-7.14	91.72	111.00
1	A	268	ASP	CA-C-N	-6.81	102.22	117.20
1	A	174	ASP	O-C-N	-5.51	113.89	122.70
1	A	42	ARG	CB-CA-C	-5.31	99.79	110.40

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	105[A]	ASP	Mainchain
1	A	269[A]	ARG	Mainchain
1	B	138	ALA	Peptide

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	3518	3456	3435	32	0
1	B	3493	3426	3422	33	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	274	0	0	7	0
3	B	206	0	0	9	0
All	All	7493	6882	6857	63	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 (63) 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:138:ALA:HB1	3:B:777:HOH:O	1.47	1.11
1:B:136:ALA:O	1:B:137:THR:OG1	2.02	0.77
1:A:139:ASP:OD2	3:A:602:HOH:O	2.03	0.76
1:A:98:ARG:NH1	1:A:99:ASP:OD1	2.22	0.73
1:B:131:PRO:HA	1:B:161:SER:HB3	1.68	0.73
1:A:267:SER:OG	1:A:269[A]:ARG:HB2	1.88	0.73
1:B:174:ASP:O	1:B:176:LEU:N	2.22	0.72
1:B:317:GLY:O	3:B:601:HOH:O	2.07	0.72
1:A:267:SER:C	1:A:269[A]:ARG:H	1.92	0.71
1:A:353:GLU:OE2	3:A:603:HOH:O	2.10	0.69
1:A:267:SER:OG	1:A:269[A]:ARG:CB	2.43	0.66
1:B:312:GLU:OE2	3:B:602:HOH:O	2.15	0.64
1:A:169:GLU:OE2	1:A:217:LYS:NZ	2.32	0.63
1:B:129:GLN:O	1:B:131:PRO:HD3	2.01	0.60
1:B:137:THR:O	1:B:137:THR:HG22	2.01	0.60

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:0:ARG:O	3:A:604:HOH:O	2.17	0.58
1:A:98:ARG:NE	3:A:612:HOH:O	2.38	0.57
1:A:174:ASP:O	1:A:178:VAL:HG23	2.05	0.57
1:B:139:ASP:CB	1:B:140:SER:HA	2.36	0.55
1:B:396:LEU:HD22	3:B:789:HOH:O	2.07	0.54
1:B:136:ALA:C	1:B:137:THR:HG1	2.09	0.53
1:B:384:GLU:OE2	3:B:603:HOH:O	2.19	0.52
1:B:37:LYS:HE2	3:B:656:HOH:O	2.10	0.52
1:B:443:ARG:NH1	3:B:608:HOH:O	2.43	0.51
1:B:138:ALA:CB	3:B:777:HOH:O	2.28	0.51
1:A:209:GLY:HA2	1:A:236:HIS:O	2.10	0.51
1:A:441:LEU:HD11	1:B:399:VAL:HB	1.93	0.51
1:B:242:PRO:O	1:B:243:LEU:HB2	2.12	0.50
1:A:108:ARG:NH1	3:A:607:HOH:O	2.31	0.50
1:B:105[A]:ASP:OD1	1:B:108:ARG:NH2	2.44	0.50
1:A:105[A]:ASP:OD1	1:A:108:ARG:NH1	2.45	0.50
1:A:378:PRO:O	1:A:387:ARG:NH1	2.45	0.50
1:B:133:PHE:HB3	1:B:138:ALA:O	2.11	0.50
1:A:129:GLN:HG2	1:A:161:SER:HB2	1.94	0.49
1:B:139:ASP:HB3	1:B:140:SER:HA	1.94	0.49
1:A:163:MET:O	1:A:178:VAL:HA	2.12	0.49
1:A:17:GLU:OE2	1:A:365[B]:ARG:NH2	2.47	0.48
1:B:299:PRO:HG3	1:B:325:THR:CG2	2.45	0.46
1:A:174:ASP:O	1:A:178:VAL:CG2	2.63	0.46
1:B:258:ARG:NH2	1:B:285:GLU:OE1	2.41	0.45
1:B:13:PHE:CD1	1:B:365:ARG:HG3	2.52	0.44
1:B:442:GLU:OE1	1:B:442:GLU:N	2.47	0.44
1:B:274:HIS:HB3	1:B:276:VAL:HG23	1.99	0.44
1:A:81:THR:OG1	3:A:601:HOH:O	1.85	0.44
1:A:330:ASN:H	1:A:331:ASP:HA	1.83	0.44
1:B:139:ASP:CG	1:B:140:SER:HA	2.38	0.44
1:A:324:THR:O	1:A:325:THR:HG22	2.18	0.43
1:A:138:ALA:HA	1:A:183:ARG:HH21	1.82	0.43
1:A:269[A]:ARG:HD3	3:A:659:HOH:O	2.18	0.42
1:A:390:ASP:C	1:A:391:ILE:HG13	2.40	0.42
1:A:341:LEU:HD23	1:B:341:LEU:HD23	2.02	0.42
1:A:20:LEU:CD2	1:A:36:GLY:HA2	2.49	0.42
1:B:150:THR:HG22	3:B:795:HOH:O	2.19	0.41
1:B:235:LEU:HB2	1:B:270:VAL:HG22	2.03	0.41
1:B:423:VAL:HB	1:B:431:VAL:HB	2.02	0.41
1:A:161:SER:HA	1:A:209:GLY:O	2.20	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:162:SER:O	1:A:211[B]:CYS:HB2	2.21	0.41
1:B:140:SER:HB2	1:B:143:ASP:HB2	2.01	0.41
1:A:20:LEU:HD12	1:A:20:LEU:N	2.36	0.41
1:A:235:LEU:HB2	1:A:270:VAL:HG22	2.03	0.40
1:B:240:TYR:CE1	1:B:256:PRO:HD2	2.57	0.40
1:B:161:SER:HA	1:B:209:GLY:O	2.20	0.40
1:A:325:THR:HG23	1:A:326:GLY:N	2.36	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	461/458 (101%)	440 (95%)	21 (5%)	0	100 100
1	B	457/458 (100%)	433 (95%)	19 (4%)	5 (1%)	14 9
All	All	918/916 (100%)	873 (95%)	40 (4%)	5 (0%)	25 26

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	137	THR
1	B	175	ASP
1	B	131	PRO
1	B	176	LEU
1	B	325	THR

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	365/366 (100%)	360 (99%)	5 (1%)	67	73
1	B	361/366 (99%)	352 (98%)	9 (2%)	47	52
All	All	726/732 (99%)	712 (98%)	14 (2%)	55	63

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	82	MET
1	A	84	SER
1	A	102	PHE
1	A	169	GLU
1	A	325	THR
1	B	38	ASN
1	B	76	GLN
1	B	98	ARG
1	B	102	PHE
1	B	140	SER
1	B	161	SER
1	B	175	ASP
1	B	258	ARG
1	B	262	LYS

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

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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 (i)

6.1 Protein, DNA and RNA chains (i)

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	456/458 (99%)	-0.17	20 (4%)	34	40	8, 20, 54, 118	0
1	B	455/458 (99%)	0.00	24 (5%)	26	32	11, 23, 60, 108	0
All	All	911/916 (99%)	-0.08	44 (4%)	30	36	8, 21, 55, 118	0

All (44) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	173	CYS	11.2
1	A	172	PHE	8.5
1	B	168	SER	8.3
1	B	176	LEU	8.2
1	B	175	ASP	7.7
1	A	174	ASP	7.7
1	B	170	GLY	7.4
1	A	-1	GLU	7.3
1	B	136	ALA	7.0
1	A	136	ALA	6.6
1	B	138	ALA	6.1
1	A	175	ASP	5.9
1	A	177	PHE	5.6
1	B	169	GLU	5.0
1	B	167	LYS	4.8
1	B	171	GLY	4.8
1	B	172	PHE	4.7
1	B	139	ASP	4.3
1	B	137	THR	4.3
1	A	43	SER	4.2
1	A	176	LEU	4.0
1	B	174	ASP	4.0
1	A	168	SER	3.8
1	B	135	GLY	3.7

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	173	CYS	3.7
1	A	137	THR	3.6
1	A	169	GLU	3.5
1	B	43	SER	3.4
1	A	135	GLY	3.0
1	A	167	LYS	2.7
1	A	454	LYS	2.7
1	B	134	PRO	2.7
1	A	45	SER	2.6
1	B	250	HIS	2.4
1	B	166	GLY	2.4
1	B	280	ARG	2.4
1	B	177	PHE	2.3
1	A	170	GLY	2.3
1	B	450	ALA	2.3
1	A	40	SER	2.2
1	A	42	ARG	2.1
1	A	171	GLY	2.1
1	B	247[A]	MET	2.1
1	B	0	ARG	2.0

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

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

6.3 Carbohydrates (i)

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
2	ZN	A	501	1/1	0.99	0.06	20,20,20,20	0
2	ZN	B	501	1/1	0.99	0.05	26,26,26,26	0

6.5 Other polymers (i)

There are no such residues in this entry.