Full wwPDB X-ray Structure Validation Report (i)

Feb 13, 2017 – 03:48 PM EST

PDB ID	:	5UC8
Title	:	Crystal structure of human Heme Oxygenase-2
Authors	:	Luo, S.; Tong, L.
Deposited on	:	2016-12-22
Resolution	:	2.00 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
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

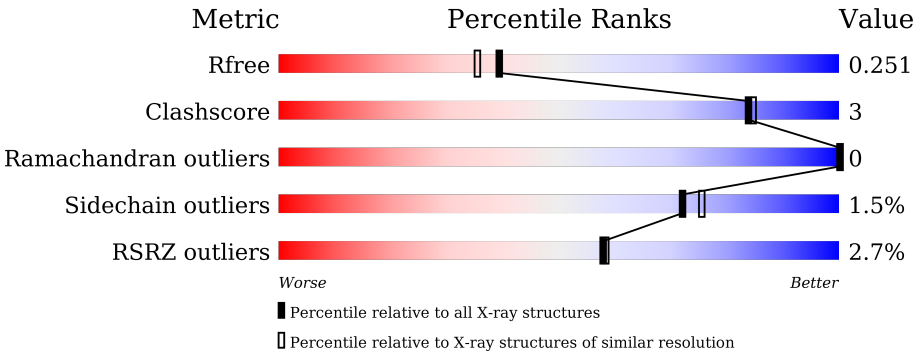
MolProbity	:	4.02b-467
Mogul	:	unknown
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20028442
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20028442

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 2.00 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}	91344	6249 (2.00-2.00)
Clashscore	102246	7340 (2.00-2.00)
Ramachandran outliers	100387	7248 (2.00-2.00)
Sidechain outliers	100360	7247 (2.00-2.00)
RSRZ outliers	91569	6262 (2.00-2.00)

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. 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	226	6% 82% 9% • 8%
1	B	226	2% 87% 5% • 7%
1	C	226	90% • 7%
1	D	226	2% 85% 7% 7%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 7601 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 Heme oxygenase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	209	Total	C	N	O	S	0	0	0
			1725	1099	291	327	8			
1	B	210	Total	C	N	O	S	0	0	0
			1730	1102	292	328	8			
1	C	210	Total	C	N	O	S	0	0	0
			1730	1102	292	328	8			
1	D	210	Total	C	N	O	S	0	0	0
			1730	1102	292	328	8			

There are 52 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	17	MET	-	initiating methionine	UNP P30519
A	18	GLY	-	expression tag	UNP P30519
A	19	SER	-	expression tag	UNP P30519
A	20	SER	-	expression tag	UNP P30519
A	21	HIS	-	expression tag	UNP P30519
A	22	HIS	-	expression tag	UNP P30519
A	23	HIS	-	expression tag	UNP P30519
A	24	HIS	-	expression tag	UNP P30519
A	25	HIS	-	expression tag	UNP P30519
A	26	HIS	-	expression tag	UNP P30519
A	27	SER	-	expression tag	UNP P30519
A	28	SER	-	expression tag	UNP P30519
A	29	GLY	-	expression tag	UNP P30519
B	17	MET	-	initiating methionine	UNP P30519
B	18	GLY	-	expression tag	UNP P30519
B	19	SER	-	expression tag	UNP P30519
B	20	SER	-	expression tag	UNP P30519
B	21	HIS	-	expression tag	UNP P30519
B	22	HIS	-	expression tag	UNP P30519
B	23	HIS	-	expression tag	UNP P30519
B	24	HIS	-	expression tag	UNP P30519

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Chain	Residue	Modelled	Actual	Comment	Reference
B	25	HIS	-	expression tag	UNP P30519
B	26	HIS	-	expression tag	UNP P30519
B	27	SER	-	expression tag	UNP P30519
B	28	SER	-	expression tag	UNP P30519
B	29	GLY	-	expression tag	UNP P30519
C	17	MET	-	initiating methionine	UNP P30519
C	18	GLY	-	expression tag	UNP P30519
C	19	SER	-	expression tag	UNP P30519
C	20	SER	-	expression tag	UNP P30519
C	21	HIS	-	expression tag	UNP P30519
C	22	HIS	-	expression tag	UNP P30519
C	23	HIS	-	expression tag	UNP P30519
C	24	HIS	-	expression tag	UNP P30519
C	25	HIS	-	expression tag	UNP P30519
C	26	HIS	-	expression tag	UNP P30519
C	27	SER	-	expression tag	UNP P30519
C	28	SER	-	expression tag	UNP P30519
C	29	GLY	-	expression tag	UNP P30519
D	17	MET	-	initiating methionine	UNP P30519
D	18	GLY	-	expression tag	UNP P30519
D	19	SER	-	expression tag	UNP P30519
D	20	SER	-	expression tag	UNP P30519
D	21	HIS	-	expression tag	UNP P30519
D	22	HIS	-	expression tag	UNP P30519
D	23	HIS	-	expression tag	UNP P30519
D	24	HIS	-	expression tag	UNP P30519
D	25	HIS	-	expression tag	UNP P30519
D	26	HIS	-	expression tag	UNP P30519
D	27	SER	-	expression tag	UNP P30519
D	28	SER	-	expression tag	UNP P30519
D	29	GLY	-	expression tag	UNP P30519

- Molecule 2 is water.

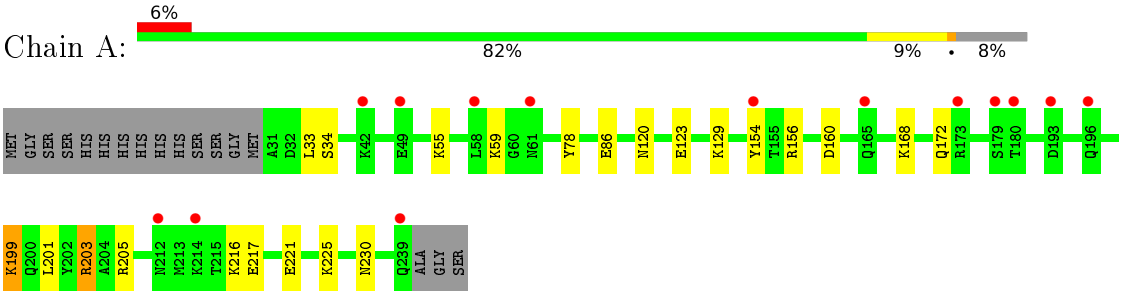
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	98	Total O 98 98	0	0
2	B	170	Total O 170 170	0	0
2	C	207	Total O 207 207	0	0
2	D	211	Total O 211 211	0	0

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 errors 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.

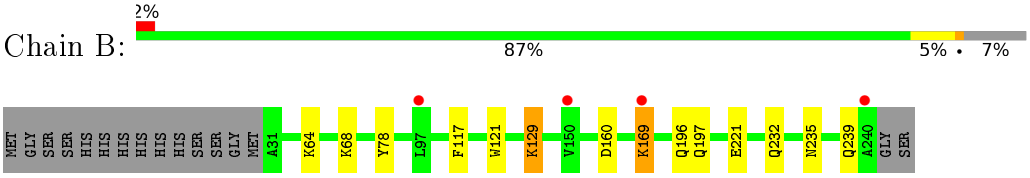
- Molecule 1: Heme oxygenase 2

Chain A:



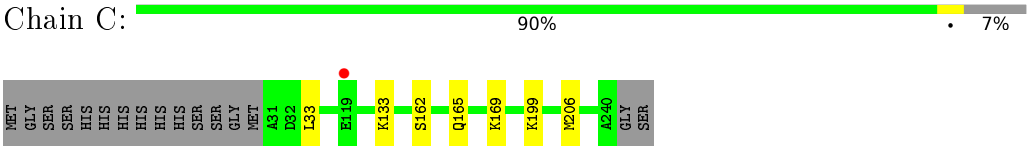
- Molecule 1: Heme oxygenase 2

Chain B:



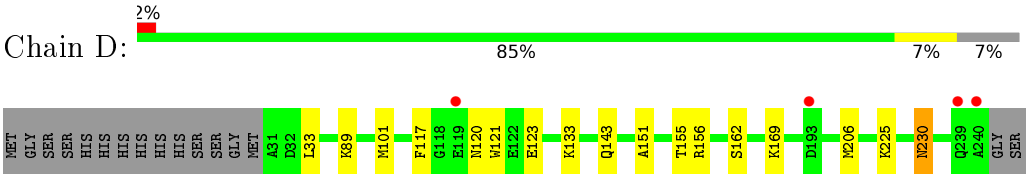
- Molecule 1: Heme oxygenase 2

Chain C:



- Molecule 1: Heme oxygenase 2

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	77.76Å 84.62Å 139.01Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	24.78 – 2.00 24.78 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.8 (24.78-2.00) 99.8 (24.78-2.00)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.76 (at 1.99Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.196 , 0.251 0.195 , 0.251	Depositor DCC
R_{free} test set	1750 reflections (2.80%)	DCC
Wilson B-factor (Å^2)	33.2	Xtriage
Anisotropy	0.076	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 46.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	7601	wwPDB-VP
Average B, all atoms (Å^2)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.77% 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

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	0.35	0/1761	0.45	0/2367
1	B	0.39	0/1766	0.48	0/2374
1	C	0.42	0/1766	0.51	0/2374
1	D	0.42	0/1766	0.51	0/2374
All	All	0.40	0/7059	0.49	0/9489

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

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	1725	0	1682	16	0
1	B	1730	0	1687	9	0
1	C	1730	0	1687	5	0
1	D	1730	0	1687	13	0
2	A	98	0	0	1	0
2	B	170	0	0	1	0
2	C	207	0	0	0	0
2	D	211	0	0	4	0
All	All	7601	0	6743	41	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 3.

All (41) 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:33:LEU:HD13	1:A:216:LYS:HG2	1.74	0.70
1:A:78:TYR:OH	1:A:160:ASP:OD2	2.08	0.68
1:A:154:TYR:OH	1:A:203:ARG:NH1	2.28	0.66
1:D:120:ASN:HD21	1:D:123:GLU:CD	1.99	0.66
1:B:235:ASN:O	1:B:239:GLN:HG2	1.97	0.64
1:A:199:LYS:HZ1	1:A:203:ARG:HE	1.53	0.56
1:D:156:ARG:NH2	1:D:230:ASN:HD21	2.02	0.56
1:D:143:GLN:NE2	2:D:303:HOH:O	2.40	0.54
1:D:151:ALA:O	1:D:155:THR:HG23	2.08	0.53
1:A:205:ARG:NH2	2:A:303:HOH:O	2.43	0.52
1:D:155:THR:HG22	2:D:481:HOH:O	2.09	0.52
1:C:165:GLN:HE21	1:C:169:LYS:HE2	1.74	0.52
1:A:199:LYS:HZ1	1:A:203:ARG:NE	2.07	0.52
1:D:33:LEU:HD23	1:D:206:MET:HG2	1.92	0.51
1:A:201:LEU:HD21	1:A:205:ARG:HH11	1.77	0.49
1:B:196:GLN:NE2	1:B:196:GLN:H	2.10	0.49
1:B:64:LYS:HE2	1:B:68:LYS:HD2	1.95	0.48
1:B:232:GLN:NE2	2:B:305:HOH:O	2.46	0.48
1:A:225:LYS:HB2	1:A:225:LYS:HE3	1.63	0.48
1:D:230:ASN:ND2	2:D:312:HOH:O	2.46	0.48
1:A:34:SER:HB2	1:A:203:ARG:HD3	1.96	0.48
1:D:225:LYS:HE3	1:D:225:LYS:HB2	1.66	0.47
1:C:162:SER:HG	1:C:199:LYS:HZ2	1.58	0.47
1:B:129:LYS:HB2	1:B:129:LYS:HE2	1.78	0.46
1:D:89:LYS:HE3	2:D:306:HOH:O	2.16	0.46
1:A:217:GLU:O	1:A:221:GLU:HG2	2.16	0.45
1:A:55:LYS:O	1:A:59:LYS:HD3	2.16	0.45
1:C:33:LEU:HD23	1:C:206:MET:HG2	1.99	0.45
1:A:156:ARG:HD3	1:A:156:ARG:HA	1.81	0.45
1:B:169:LYS:HA	1:B:169:LYS:HD2	1.80	0.45
1:D:169:LYS:HD2	1:D:169:LYS:HA	1.75	0.44
1:C:165:GLN:O	1:C:169:LYS:HD3	2.18	0.44
1:A:168:LYS:O	1:A:172:GLN:HG3	2.18	0.43
1:A:201:LEU:HD21	1:A:205:ARG:NH1	2.34	0.43
1:B:78:TYR:OH	1:B:160:ASP:OD2	2.15	0.42
1:A:221:GLU:OE1	1:D:133:LYS:NZ	2.53	0.41
1:A:120:ASN:ND2	1:A:123:GLU:OE1	2.33	0.40
1:B:117:PHE:HB2	1:B:121:TRP:HB3	2.04	0.40
1:D:120:ASN:HA	1:D:120:ASN:HD22	1.63	0.40
1:B:221:GLU:OE2	1:C:133:LYS:HE3	2.22	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:117:PHE:HB2	1:D:121:TRP:HB3	2.03	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	207/226 (92%)	199 (96%)	8 (4%)	0	100	100
1	B	208/226 (92%)	203 (98%)	5 (2%)	0	100	100
1	C	208/226 (92%)	205 (99%)	3 (1%)	0	100	100
1	D	208/226 (92%)	206 (99%)	2 (1%)	0	100	100
All	All	831/904 (92%)	813 (98%)	18 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	180/193 (93%)	175 (97%)	5 (3%)	51	50
1	B	180/193 (93%)	177 (98%)	3 (2%)	68	71
1	C	180/193 (93%)	180 (100%)	0	100	100
1	D	180/193 (93%)	177 (98%)	3 (2%)	68	71

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	720/772 (93%)	709 (98%)	11 (2%)	72 75

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	86	GLU
1	A	129	LYS
1	A	199	LYS
1	A	203	ARG
1	A	230	ASN
1	B	129	LYS
1	B	169	LYS
1	B	197	GLN
1	D	101	MET
1	D	162	SER
1	D	230	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (19) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	50	ASN
1	A	52	GLN
1	A	230	ASN
1	A	239	GLN
1	B	143	GLN
1	B	196	GLN
1	B	200	GLN
1	B	232	GLN
1	C	61	ASN
1	C	126	GLN
1	C	143	GLN
1	C	165	GLN
1	C	200	GLN
1	C	232	GLN
1	C	239	GLN
1	D	50	ASN
1	D	120	ASN
1	D	143	GLN
1	D	230	ASN

5.3.3 RNA

There are no RNA molecules 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, 95^{th} 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	209/226 (92%)	0.46	14 (6%) 21 22	31, 47, 63, 68	0
1	B	210/226 (92%)	0.12	4 (1%) 70 70	23, 36, 50, 59	0
1	C	210/226 (92%)	-0.05	1 (0%) 91 92	20, 32, 46, 54	0
1	D	210/226 (92%)	0.01	4 (1%) 70 70	21, 32, 46, 54	0
All	All	839/904 (92%)	0.14	23 (2%) 58 58	20, 36, 57, 68	0

All (23) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	240	ALA	5.0
1	A	61	ASN	3.4
1	D	239	GLN	3.1
1	A	239	GLN	3.0
1	A	58	LEU	2.9
1	A	193	ASP	2.7
1	A	180	THR	2.7
1	A	154	TYR	2.7
1	B	97	LEU	2.6
1	B	240	ALA	2.5
1	B	169	LYS	2.4
1	A	42	LYS	2.4
1	A	179	SER	2.3
1	A	214	LYS	2.2
1	D	119	GLU	2.2
1	D	193	ASP	2.2
1	A	49	GLU	2.2
1	A	173	ARG	2.2
1	C	119	GLU	2.1
1	A	212	ASN	2.1
1	A	196	GLN	2.0

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Mol	Chain	Res	Type	RSRZ
1	B	150	VAL	2.0
1	A	165	GLN	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 carbohydrates in this entry.

6.4 Ligands (i)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.