



# wwPDB X-ray Structure Validation Summary Report

Feb 28, 2014 – 06:47 PM GMT

PDB ID : 2WU2  
Title : CRYSTAL STRUCTURE OF THE E. COLI SUCCINATE:QUINONE OXIDOREDUCTASE (SQR) SDHC HIS84MET MUTANT  
Authors : Ruprecht, J.; Yankovskaya, V.; Maklashina, E.; Iwata, S.; Cecchini, G.  
Deposited on : 2009-09-28  
Resolution : 2.50 Å(reported)

This is a wwPDB validation summary 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 <http://wwpdb.org/ValidationPDFNotes.html>

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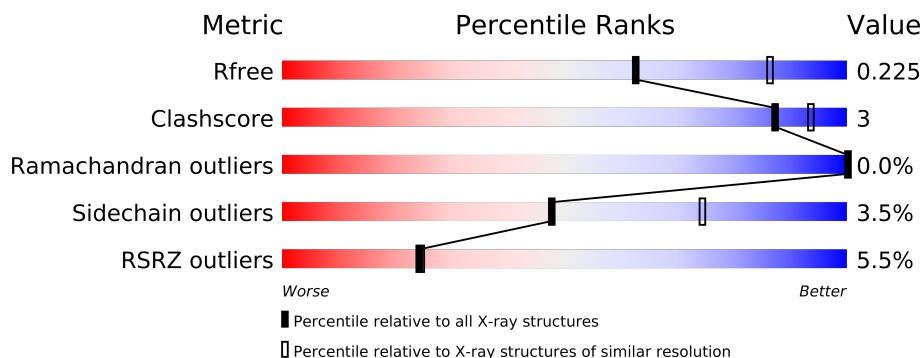
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity	:	4.02b-467
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 2.50 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	2784 (2.50-2.50)
Clashscore	79885	3562 (2.50-2.50)
Ramachandran outliers	78287	3480 (2.50-2.50)
Sidechain outliers	78261	3482 (2.50-2.50)
RSRZ outliers	66119	2785 (2.50-2.50)

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  $\geq 3$ , 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	588	
1	E	588	
1	I	588	
2	B	238	
2	F	238	
2	J	238	
3	C	129	
3	G	129	
3	K	129	
4	D	115	
4	H	115	
4	L	115	

The following table lists non-polymeric compounds that are outliers for geometric or electron-

density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
7	NA	E	1590	-	X
7	NA	I	1590	-	X

## 2 Entry composition

There are 13 unique types of molecules in this entry. The entry contains 25960 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 SUCCINATE DEHYDROGENASE FLAVOPROTEIN SUB-UNIT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	588	Total	C	N	O	S	0	0	0
			4522	2812	821	861	28			
1	E	588	Total	C	N	O	S	0	0	0
			4522	2812	821	861	28			
1	I	588	Total	C	N	O	S	0	0	0
			4522	2812	821	861	28			

- Molecule 2 is a protein called SUCCINATE DEHYDROGENASE IRON-SULFUR SUB-UNIT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	238	Total	C	N	O	S	0	0	0
			1869	1172	329	348	20			
2	F	238	Total	C	N	O	S	0	0	0
			1869	1172	329	348	20			
2	J	238	Total	C	N	O	S	0	0	0
			1869	1172	329	348	20			

- Molecule 3 is a protein called SUCCINATE DEHYDROGENASE CYTOCHROME B556 SUBUNIT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	122	Total	C	N	O	S	0	0	0
			946	629	151	160	6			
3	G	122	Total	C	N	O	S	0	0	0
			946	629	151	160	6			
3	K	122	Total	C	N	O	S	0	0	0
			946	629	151	160	6			

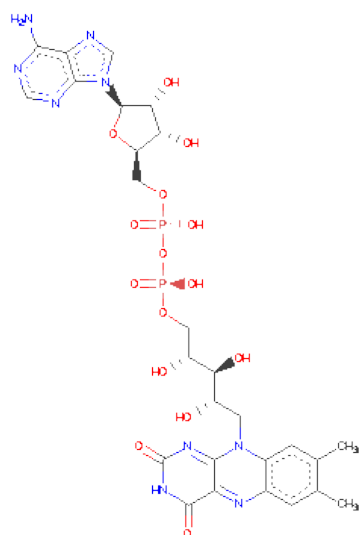
There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	84	MET	HIS	ENGINEERED MUTATION	UNP P69054
G	84	MET	HIS	ENGINEERED MUTATION	UNP P69054
K	84	MET	HIS	ENGINEERED MUTATION	UNP P69054

- Molecule 4 is a protein called SUCCINATE DEHYDROGENASE HYDROPHOBIC MEMBRANE ANCHOR PROTEIN SUBUNIT.

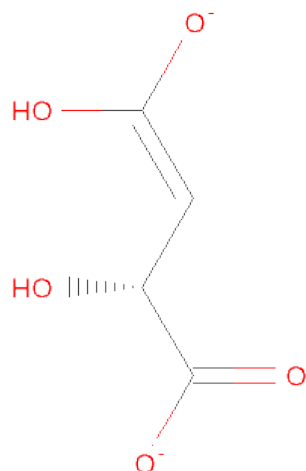
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	105	Total	C	N	O	S	0	0	0
			836	577	123	133	3			
4	H	105	Total	C	N	O	S	0	0	0
			836	577	123	133	3			
4	L	105	Total	C	N	O	S	0	0	0
			836	577	123	133	3			

- Molecule 5 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula:  $C_{27}H_{33}N_9O_{15}P_2$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
5	E	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
5	I	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 6 is MALATE LIKE INTERMEDIATE (three-letter code: TEO) (formula:  $C_4H_4O_5$ ).

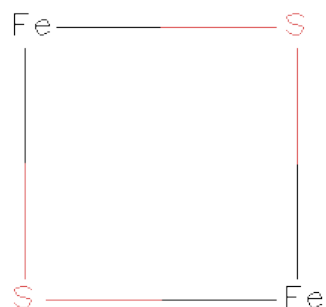


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			9	4	5		
6	E	1	Total	C	O	0	0
			9	4	5		
6	I	1	Total	C	O	0	0
			9	4	5		

- Molecule 7 is SODIUM ION (three-letter code: NA) (formula: Na).

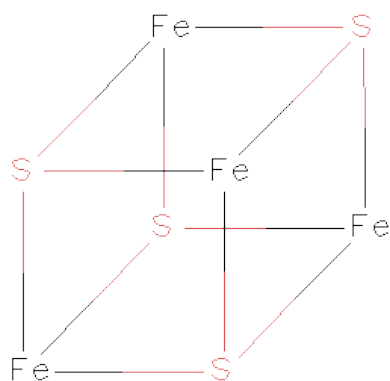
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	I	1	Total	Na	0	0
			1	1		
7	A	1	Total	Na	0	0
			1	1		
7	E	1	Total	Na	0	0
			1	1		

- Molecule 8 is FE2/S2 (INORGANIC) CLUSTER (three-letter code: FES) (formula: Fe<sub>2</sub>S<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	B	1	Total	Fe	S	0	0
			4	2	2		
8	F	1	Total	Fe	S	0	0
			4	2	2		
8	J	1	Total	Fe	S	0	0
			4	2	2		

- Molecule 9 is IRON/SULFUR CLUSTER (three-letter code: SF4) (formula:  $\text{Fe}_4\text{S}_4$ ).



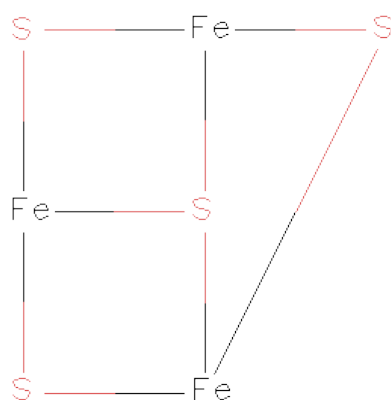
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	B	1	Total	Fe	S	0	0
			8	4	4		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	F	1	Total	Fe	S	0	0
			8	4	4		
9	J	1	Total	Fe	S	0	0
			8	4	4		

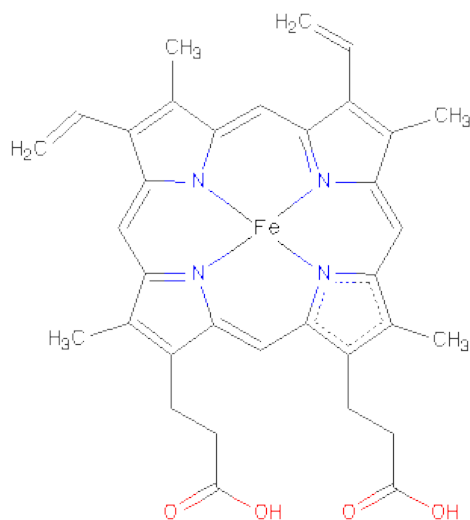
- Molecule 10 is FE3-S4 CLUSTER (three-letter code: F3S) (formula:  $\text{Fe}_3\text{S}_4$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
10	B	1	Total	Fe	S	0	0
			7	3	4		
10	F	1	Total	Fe	S	0	0
			7	3	4		
10	J	1	Total	Fe	S	0	0
			7	3	4		

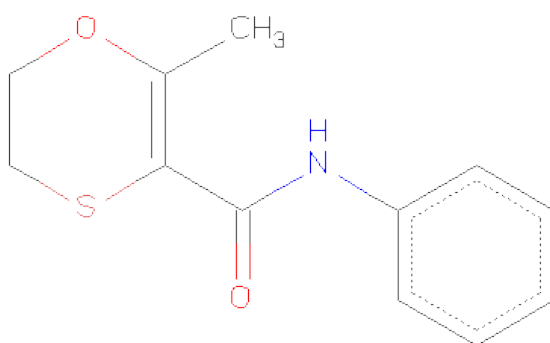
- Molecule 11 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula:  $\text{C}_{34}\text{H}_{32}\text{FeN}_4\text{O}_4$ ).





Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
11	C	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
11	G	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
11	K	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

- Molecule 12 is 2-METHYL-N-PHENYL-5,6-DIHYDRO-1,4-OXATHIINE-3-CARBOXAMIDE (three-letter code: CBE) (formula:  $C_{12}H_{13}NO_2S$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
12	C	1	Total 16	C 12	N 1	O 2	S 1	0	0
12	G	1	Total 16	C 12	N 1	O 2	S 1	0	0
12	K	1	Total 16	C 12	N 1	O 2	S 1	0	0

- Molecule 13 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
13	A	278	Total 278	O 278	0	0
13	B	117	Total 117	O 117	0	0
13	C	16	Total 16	O 16	0	0
13	D	20	Total 20	O 20	0	0
13	E	197	Total 197	O 197	0	0
13	F	97	Total 97	O 97	0	0
13	G	7	Total 7	O 7	0	0
13	H	8	Total 8	O 8	0	0
13	I	167	Total 167	O 167	0	0
13	J	91	Total 91	O 91	0	0
13	K	10	Total 10	O 10	0	0
13	L	10	Total 10	O 10	0	0

### 3 Residue-property plots

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.

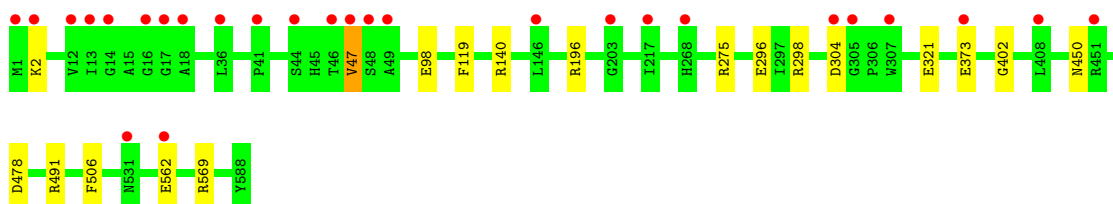
- Molecule 1: SUCCINATE DEHYDROGENASE FLAVOPROTEIN SUBUNIT

Chain A: 



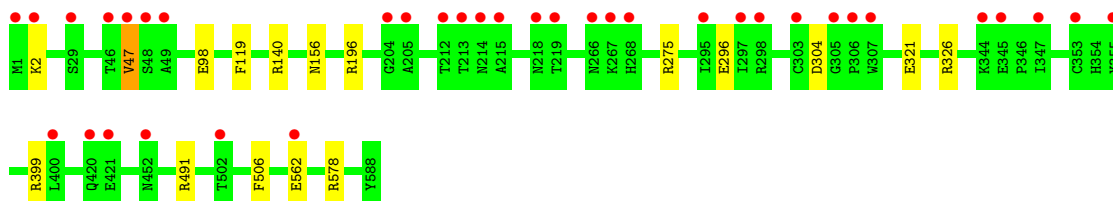
- Molecule 1: SUCCINATE DEHYDROGENASE FLAVOPROTEIN SUBUNIT

Chain E: 



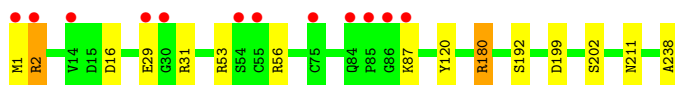
- Molecule 1: SUCCINATE DEHYDROGENASE FLAVOPROTEIN SUBUNIT

Chain I: 



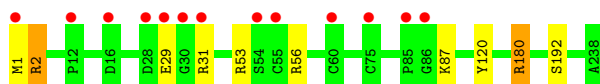
- Molecule 2: SUCCINATE DEHYDROGENASE IRON-SULFUR SUBUNIT

Chain B: 



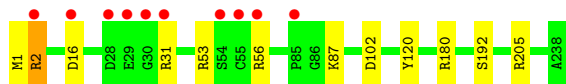
- Molecule 2: SUCCINATE DEHYDROGENASE IRON-SULFUR SUBUNIT

Chain F: 



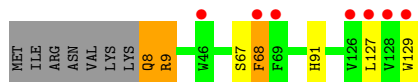
- Molecule 2: SUCCINATE DEHYDROGENASE IRON-SULFUR SUBUNIT

Chain J:



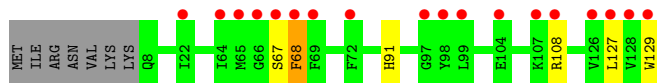
- Molecule 3: SUCCINATE DEHYDROGENASE CYTOCHROME B556 SUBUNIT

Chain C:



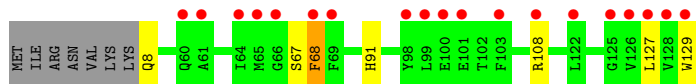
- Molecule 3: SUCCINATE DEHYDROGENASE CYTOCHROME B556 SUBUNIT

Chain G:



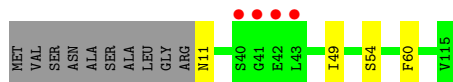
- Molecule 3: SUCCINATE DEHYDROGENASE CYTOCHROME B556 SUBUNIT

Chain K:



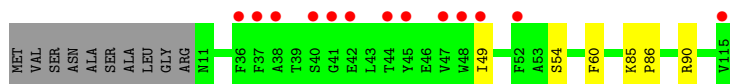
- Molecule 4: SUCCINATE DEHYDROGENASE HYDROPHOBIC MEMBRANE ANCHOR PROTEIN SUBUNIT

Chain D:



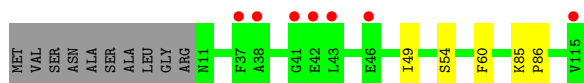
- Molecule 4: SUCCINATE DEHYDROGENASE HYDROPHOBIC MEMBRANE ANCHOR PROTEIN SUBUNIT

Chain H:



- Molecule 4: SUCCINATE DEHYDROGENASE HYDROPHOBIC MEMBRANE ANCHOR PROTEIN SUBUNIT

Chain L:



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	120.03Å 183.36Å 202.72Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.00 – 2.50 47.98 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.7 (48.00-2.50) 99.7 (47.98-2.50)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.23 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, $R_{free}$	0.177 , 0.214 0.188 , 0.225	Depositor DCC
$R_{free}$ test set	7724 reflections (5.29%)	DCC
Wilson B-factor (Å <sup>2</sup> )	42.4	Xtriage
Anisotropy	0.227	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 24.7	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Outliers	0 of 153822 reflections	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	25960	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.26% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

## 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: CBE, NA, SF4, TEO, F3S, FES, HEM, FAD

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	0.79	1/4611 (0.0%)	0.73	3/6237 (0.0%)
1	E	0.71	0/4611	0.71	1/6237 (0.0%)
1	I	0.67	0/4611	0.69	1/6237 (0.0%)
2	B	0.76	0/1908	0.77	1/2578 (0.0%)
2	F	0.68	0/1908	0.71	1/2578 (0.0%)
2	J	0.71	0/1908	0.74	1/2578 (0.0%)
3	C	0.68	0/967	0.64	1/1311 (0.1%)
3	G	0.64	0/967	0.61	0/1311
3	K	0.62	0/967	0.60	0/1311
4	D	0.66	0/859	0.57	0/1175
4	H	0.64	0/859	0.59	0/1175
4	L	0.59	0/859	0.56	0/1175
All	All	0.71	1/25035 (0.0%)	0.70	9/33903 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	496	ASN	CB-CG	5.93	1.64	1.51

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	47	VAL	CB-CA-C	-6.18	99.65	111.40
2	B	180	ARG	CG-CD-NE	6.17	124.76	111.80
1	E	47	VAL	CB-CA-C	-6.08	99.84	111.40
1	I	47	VAL	CB-CA-C	-6.04	99.92	111.40
1	A	491	ARG	NE-CZ-NH2	-5.82	117.39	120.30

There are no chirality outliers.

There are no planarity outliers.

## 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	4522	0	0	9	0
1	E	4522	0	0	8	0
1	I	4522	0	0	7	0
2	B	1869	0	0	3	0
2	F	1869	0	0	1	0
2	J	1869	0	0	1	0
3	C	946	0	0	3	0
3	G	946	0	0	1	0
3	K	946	0	0	1	0
4	D	836	0	0	1	0
4	H	836	0	0	2	0
4	L	836	0	0	1	0
5	A	53	0	29	4	0
5	E	53	0	30	4	0
5	I	53	0	30	6	0
6	A	9	0	3	3	0
6	E	9	0	3	4	0
6	I	9	0	3	7	0
7	A	1	0	0	0	0
7	E	1	0	0	0	0
7	I	1	0	0	0	0
8	B	4	0	0	0	0
8	F	4	0	0	0	0
8	J	4	0	0	0	0
9	B	8	0	0	0	0
9	F	8	0	0	0	0
9	J	8	0	0	0	0
10	B	7	0	0	0	0
10	F	7	0	0	0	0
10	J	7	0	0	0	0
11	C	43	0	30	4	0
11	G	43	0	30	2	0
11	K	43	0	30	3	0
12	C	16	0	13	2	0
12	G	16	0	13	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
12	K	16	0	13	1	0
13	A	278	0	0	5	0
13	B	117	0	0	0	0
13	C	16	0	0	0	0
13	D	20	0	0	1	0
13	E	197	0	0	6	0
13	F	97	0	0	0	0
13	G	7	0	0	0	0
13	H	8	0	0	0	0
13	I	167	0	0	2	0
13	J	91	0	0	0	0
13	K	10	0	0	0	0
13	L	10	0	0	0	0
All	All	25960	0	227	64	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 3.

The worst 5 of 64 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
11:C:1130:HEM:HBB2	11:C:1130:HEM:HHC	1.65	0.78
1:E:298:ARG:CD	13:E:2100:HOH:O	2.36	0.73
12:C:1131:CBE:H16	12:C:1131:CBE:O9	1.87	0.72
5:A:601:FAD:N5	6:A:1589:TEO:H2	2.04	0.72
4:D:11:ASN:N	13:D:2005:HOH:O	2.25	0.70

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	586/588 (100%)	572 (98%)	14 (2%)	0	100	100
1	E	586/588 (100%)	574 (98%)	12 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	I	586/588 (100%)	573 (98%)	13 (2%)	0	100	100
2	B	236/238 (99%)	226 (96%)	10 (4%)	0	100	100
2	F	236/238 (99%)	226 (96%)	10 (4%)	0	100	100
2	J	236/238 (99%)	225 (95%)	10 (4%)	1 (0%)	43	66
3	C	120/129 (93%)	119 (99%)	1 (1%)	0	100	100
3	G	120/129 (93%)	119 (99%)	1 (1%)	0	100	100
3	K	120/129 (93%)	120 (100%)	0	0	100	100
4	D	103/115 (90%)	102 (99%)	1 (1%)	0	100	100
4	H	103/115 (90%)	102 (99%)	1 (1%)	0	100	100
4	L	103/115 (90%)	101 (98%)	2 (2%)	0	100	100
All	All	3135/3210 (98%)	3059 (98%)	75 (2%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	J	102	ASP

### 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	473/473 (100%)	462 (98%)	11 (2%)	63	87
1	E	473/473 (100%)	463 (98%)	10 (2%)	66	88
1	I	473/473 (100%)	462 (98%)	11 (2%)	63	87
2	B	208/208 (100%)	196 (94%)	12 (6%)	28	49
2	F	208/208 (100%)	198 (95%)	10 (5%)	35	60
2	J	208/208 (100%)	198 (95%)	10 (5%)	35	60
3	C	102/109 (94%)	96 (94%)	6 (6%)	28	48
3	G	102/109 (94%)	96 (94%)	6 (6%)	28	48
3	K	102/109 (94%)	95 (93%)	7 (7%)	22	39

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
4	D	88/96 (92%)	85 (97%)	3 (3%)	49	75
4	H	88/96 (92%)	85 (97%)	3 (3%)	49	75
4	L	88/96 (92%)	85 (97%)	3 (3%)	49	75
All	All	2613/2658 (98%)	2521 (96%)	92 (4%)	48	74

5 of 92 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	562	GLU
2	F	192	SER
3	K	91	HIS
2	F	1	MET
2	F	53	ARG

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

### 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 ⓘ

Of 24 ligands modelled in this entry, 3 are monoatomic - leaving 21 for Mogul analysis.

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$
6	TEO	A	1589	-	5,8,8	1.06	0	3,10,10	1.13	0
5	FAD	A	601	1	58,58,58	1.18	5 (8%)	85,89,89	2.00	15 (17%)
8	FES	B	302	2	0,4,4	0.00	-	0,4,4	0.00	-
9	SF4	B	303	2	12,12,12	7.69	10 (83%)	0,24,24	0.00	-
10	F3S	B	304	2	3,9,9	93.56	3 (100%)	0,15,15	0.00	-
11	HEM	C	1130	3,4	49,50,50	2.48	17 (34%)	46,82,82	2.34	10 (21%)
12	CBE	C	1131	-	17,17,17	1.11	1 (5%)	22,22,22	1.58	4 (18%)
6	TEO	E	1589	-	5,8,8	1.18	1 (20%)	3,10,10	1.33	1 (33%)
5	FAD	E	601	1	58,58,58	1.29	5 (8%)	85,89,89	2.22	18 (21%)
8	FES	F	302	2	0,4,4	0.00	-	0,4,4	0.00	-
9	SF4	F	303	2	12,12,12	7.14	12 (100%)	0,24,24	0.00	-
10	F3S	F	304	2	3,9,9	17.59	3 (100%)	0,15,15	0.00	-
11	HEM	G	1130	3,4	49,50,50	2.28	13 (26%)	46,82,82	1.94	7 (15%)
12	CBE	G	1131	-	17,17,17	1.09	2 (11%)	22,22,22	1.23	3 (13%)
6	TEO	I	1589	-	5,8,8	0.97	0	3,10,10	1.37	1 (33%)
5	FAD	I	601	1	58,58,58	1.13	5 (8%)	85,89,89	2.08	20 (23%)
8	FES	J	302	2	0,4,4	0.00	-	0,4,4	0.00	-
9	SF4	J	303	2	12,12,12	6.65	10 (83%)	0,24,24	0.00	-
10	F3S	J	304	2	3,9,9	90.77	3 (100%)	0,15,15	0.00	-
11	HEM	K	1130	3,4	49,50,50	2.15	12 (24%)	46,82,82	2.10	8 (17%)
12	CBE	K	1131	-	17,17,17	1.24	2 (11%)	22,22,22	1.08	1 (4%)

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
6	TEO	A	1589	-	-	0/2/8/8	0/0/0/0
5	FAD	A	601	1	-	0/34/50/50	0/1/6/6
8	FES	B	302	2	-	0/0/4/4	0/0/1/1
9	SF4	B	303	2	-	0/0/48/48	0/0/5/5
10	F3S	B	304	2	-	0/0/24/24	0/0/3/3
11	HEM	C	1130	3,4	-	0/14/114/114	0/0/8/8
12	CBE	C	1131	-	-	0/8/19/19	0/2/2/2
6	TEO	E	1589	-	-	0/2/8/8	0/0/0/0

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	FAD	E	601	1	-	0/34/50/50	0/1/6/6
8	FES	F	302	2	-	0/0/4/4	0/0/1/1
9	SF4	F	303	2	-	0/0/48/48	0/0/5/5
10	F3S	F	304	2	-	0/0/24/24	0/0/3/3
11	HEM	G	1130	3,4	-	0/14/114/114	0/0/8/8
12	CBE	G	1131	-	-	0/8/19/19	0/2/2/2
6	TEO	I	1589	-	-	0/2/8/8	0/0/0/0
5	FAD	I	601	1	-	0/34/50/50	0/1/6/6
8	FES	J	302	2	-	0/0/4/4	0/0/1/1
9	SF4	J	303	2	-	0/0/48/48	0/0/5/5
10	F3S	J	304	2	-	0/0/24/24	0/0/3/3
11	HEM	K	1130	3,4	-	0/14/114/114	0/0/8/8
12	CBE	K	1131	-	-	0/8/19/19	0/2/2/2

The worst 5 of 104 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
10	B	304	F3S	S3-FE4	159.02	3.40	2.33
10	J	304	F3S	S3-FE4	153.39	3.36	2.33
10	J	304	F3S	S3-FE1	-26.60	2.15	2.33
10	B	304	F3S	S3-FE3	-26.55	2.15	2.33
10	F	304	F3S	S3-FE3	-24.87	2.16	2.33

The worst 5 of 88 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	E	601	FAD	N3A-C2A-N1A	-12.10	118.59	128.71
5	A	601	FAD	N3A-C2A-N1A	-11.34	119.23	128.71
11	C	1130	HEM	C3B-C4B-NB	-10.27	106.65	114.00
5	I	601	FAD	N3A-C2A-N1A	-9.47	120.79	128.71
11	K	1130	HEM	C3B-C4B-NB	-8.61	107.84	114.00

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	588/588 (100%)	-0.11	9 (1%) 70 72	26, 39, 56, 67	0
1	E	588/588 (100%)	0.08	27 (4%) 31 32	32, 46, 69, 79	0
1	I	588/588 (100%)	0.20	36 (6%) 21 20	32, 49, 72, 84	0
2	B	238/238 (100%)	0.01	12 (5%) 28 28	28, 38, 60, 74	0
2	F	238/238 (100%)	-0.06	13 (5%) 24 24	34, 43, 72, 89	0
2	J	238/238 (100%)	-0.04	10 (4%) 35 36	33, 44, 75, 94	0
3	C	122/129 (94%)	0.15	7 (5%) 23 23	41, 57, 85, 92	0
3	G	122/129 (94%)	0.61	18 (14%) 3 3	47, 66, 97, 106	0
3	K	122/129 (94%)	0.67	19 (15%) 3 2	52, 71, 109, 117	0
4	D	105/115 (91%)	0.13	4 (3%) 38 40	38, 51, 79, 90	0
4	H	105/115 (91%)	0.40	13 (12%) 5 4	41, 53, 109, 128	0
4	L	105/115 (91%)	0.31	7 (6%) 17 17	43, 56, 105, 125	0
All	All	3159/3210 (98%)	0.11	175 (5%) 24 24	26, 47, 80, 128	0

The worst 5 of 175 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	G	129	TRP	10.7
3	G	68	PHE	10.1
3	K	129	TRP	9.6
3	G	69	PHE	6.3
1	I	1	MET	6.1

### 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 ⓘ

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95<sup>th</sup> 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	RSR	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
7	NA	I	1590	1/1	0.44	3.90	32,32,32,32	0
7	NA	E	1590	1/1	0.28	2.37	30,30,30,30	0
6	TEO	A	1589	9/9	0.25	1.75	31,32,37,38	0
7	NA	A	1590	1/1	0.22	1.45	22,22,22,22	0
6	TEO	I	1589	9/9	0.28	0.95	44,47,48,51	0
9	SF4	B	303	8/8	0.17	0.62	26,27,28,29	0
6	TEO	E	1589	9/9	0.17	0.44	34,37,41,42	0
12	CBE	G	1131	16/16	0.14	0.29	36,40,44,46	0
9	SF4	J	303	8/8	0.16	0.25	31,34,36,37	0
9	SF4	F	303	8/8	0.14	0.14	33,34,36,37	0
11	HEM	G	1130	43/43	0.13	0.04	39,45,51,54	0
5	FAD	A	601	53/53	0.20	-0.03	21,29,40,45	0
5	FAD	E	601	53/53	0.22	-0.16	31,38,43,46	0
5	FAD	I	601	53/53	0.20	-0.39	26,39,47,50	0
11	HEM	C	1130	43/43	0.12	-0.54	37,41,47,48	0
11	HEM	K	1130	43/43	0.12	-0.80	39,43,51,56	0
12	CBE	C	1131	16/16	0.11	-0.84	27,31,34,35	0
10	F3S	J	304	7/7	0.10	-1.02	35,37,39,42	0
8	FES	J	302	4/4	0.18	-1.02	38,38,39,39	0
10	F3S	B	304	7/7	0.12	-1.18	29,30,34,36	0
12	CBE	K	1131	16/16	0.10	-1.21	43,46,47,47	0
8	FES	B	302	4/4	0.17	-1.56	26,27,27,30	0
8	FES	F	302	4/4	0.17	-1.66	33,33,35,36	0
10	F3S	F	304	7/7	0.08	-1.74	35,37,40,41	0

### 6.5 Other polymers ⓘ

There are no such residues in this entry.