



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 1, 2016 – 02:03 AM GMT

PDB ID : 2FBW
Title : Avian respiratory complex II with carboxin bound
Authors : Huang, L.S.; Sun, G.; Cobessi, D.; Wang, A.C.; Shen, J.T.; Tung, E.Y.; Anderson, V.E.; Berry, E.A.
Deposited on : 2005-12-10
Resolution : 2.10 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 ⓘ symbol.

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

MolProbity : 4.02b-467
Mogul : 1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
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) : trunk26865

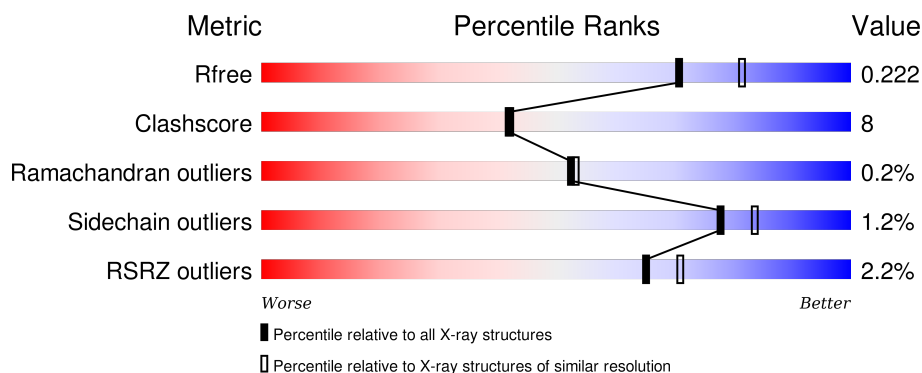
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 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.



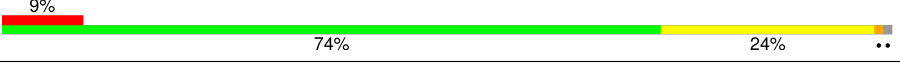
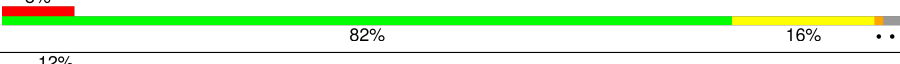

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	91344	3939 (2.10-2.10)
Clashscore	102246	4460 (2.10-2.10)
Ramachandran outliers	100387	4413 (2.10-2.10)
Sidechain outliers	100360	4414 (2.10-2.10)
RSRZ outliers	91569	3948 (2.10-2.10)

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 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 $\leq 5\%$. 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	621	<div> <div style="width: 87%;"></div> <div style="width: 12%;"></div> <div style="width: 1%;"></div> </div> <div>87% 12% .</div>
1	N	621	<div> <div style="width: 85%;"></div> <div style="width: 13%;"></div> <div style="width: 2%;"></div> </div> <div>85% 13% .</div>
2	B	252	<div> <div style="width: 84%;"></div> <div style="width: 10%;"></div> <div style="width: 5%;"></div> <div style="width: 1%;"></div> </div> <div>84% 10% . 5%</div>
2	O	252	<div> <div style="width: 84%;"></div> <div style="width: 10%;"></div> <div style="width: 5%;"></div> <div style="width: 1%;"></div> </div> <div>84% 10% . 5%</div>
3	C	141	<div> <div style="width: 74%;"></div> <div style="width: 23%;"></div> <div style="width: 3%;"></div> <div style="width: 4%;"></div> </div> <div>74% 23% .. 4%</div>

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Mol	Chain	Length	Quality of chain
3	P	141	
4	D	103	
4	Q	103	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
11	F3S	O	1004	-	-	-	X
13	CBE	C	144	-	-	X	X
13	CBE	P	202	-	-	X	X
14	TEO	A	1002	X	-	-	-
14	TEO	N	1002	X	-	-	-
15	PEE	D	109	-	-	-	X
15	PEE	Q	210	-	-	-	X
16	UNL	A	1003	-	-	X	-
16	UNL	A	1004	-	-	X	-
16	UNL	B	1005	-	-	X	-
16	UNL	C	145	-	-	X	-
16	UNL	C	214	-	-	X	X
16	UNL	C	272	-	-	-	X
16	UNL	N	1003	-	-	X	-
16	UNL	O	1005	-	-	X	-
16	UNL	P	211	-	-	X	X
17	GOL	B	1010	-	-	-	X
17	GOL	C	294	-	-	-	X
17	GOL	O	1009	-	-	-	X
17	GOL	P	208	-	-	-	X
5	BHG	C	142	X	-	-	X
5	BHG	P	204	X	-	-	-

2 Entry composition

There are 18 unique types of molecules in this entry. The entry contains 19494 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 Succinate dehydrogenase flavoprotein subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	613	Total	C	N	O	S	0	0	0
			4731	2959	844	899	29			
1	N	612	Total	C	N	O	S	0	0	0
			4725	2956	843	897	29			

- Molecule 2 is a protein called succinate dehydrogenase Ip subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	239	Total	C	N	O	S	0	0	0
			1918	1213	325	358	22			
2	O	239	Total	C	N	O	S	0	0	0
			1918	1213	325	358	22			

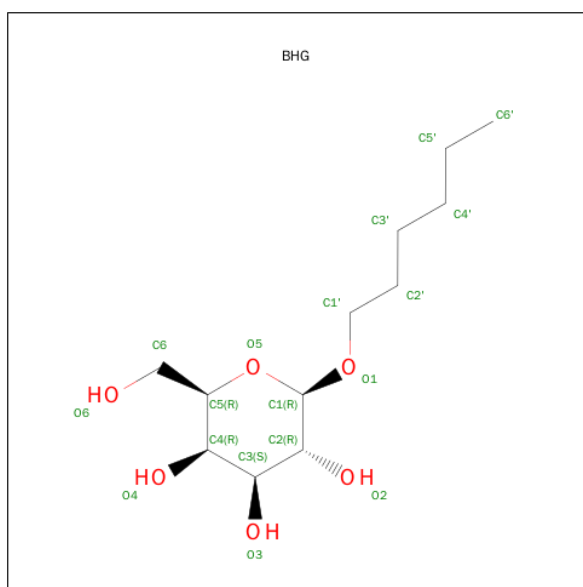
- Molecule 3 is a protein called Succinate dehydrogenase cytochrome B, large subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	140	Total	C	N	O	S	0	0	0
			1078	708	179	187	4			
3	P	140	Total	C	N	O	S	0	0	0
			1078	708	179	187	4			

- Molecule 4 is a protein called Succinate dehydrogenase cytochrome B, small subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	101	Total	C	N	O	S	0	0	0
			765	505	121	136	3			
4	Q	101	Total	C	N	O	S	0	0	0
			765	505	121	136	3			

- Molecule 5 is SUGAR (2-HEXYLOXY-6-HYDROXYMETHYL-TETRAHYDRO-PYRAN-3,4,5-TRIOL) (three-letter code: BHG) (formula: C₁₂H₂₄O₆).

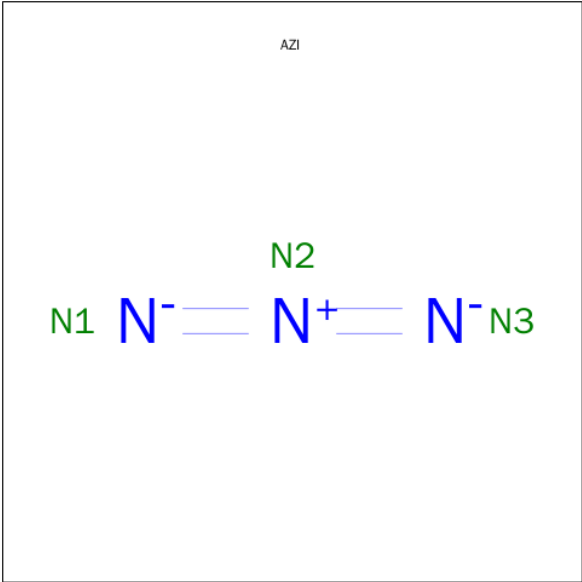


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	C	1	Total	C	O	0	0
			18	12	6		
5	P	1	Total	C	O	0	0
			18	12	6		

- Molecule 6 is POTASSIUM ION (three-letter code: K) (formula: K).

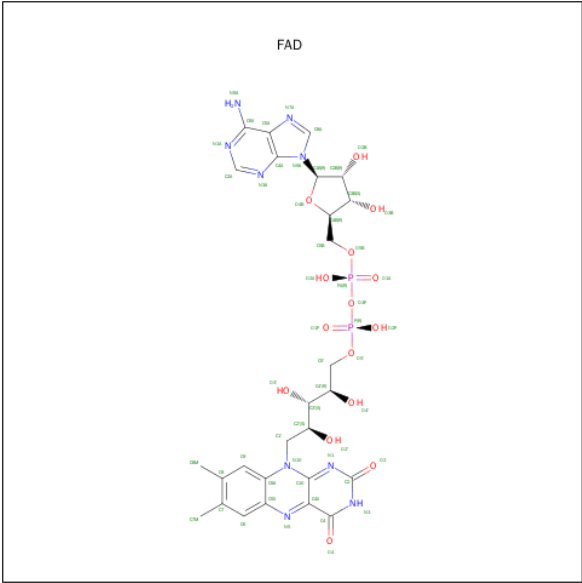
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	O	1	Total	K	0	0
			1	1		
6	B	1	Total	K	0	0
			1	1		
6	A	1	Total	K	0	0
			1	1		
6	N	1	Total	K	0	0
			1	1		

- Molecule 7 is AZIDE ION (three-letter code: AZI) (formula: N₃).



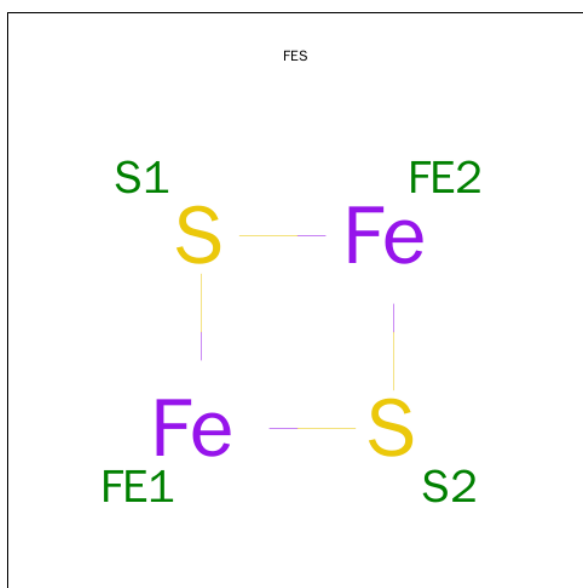
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	1	Total N 3 3	0	0

- Molecule 8 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: C₂₇H₃₃N₉O₁₅P₂).



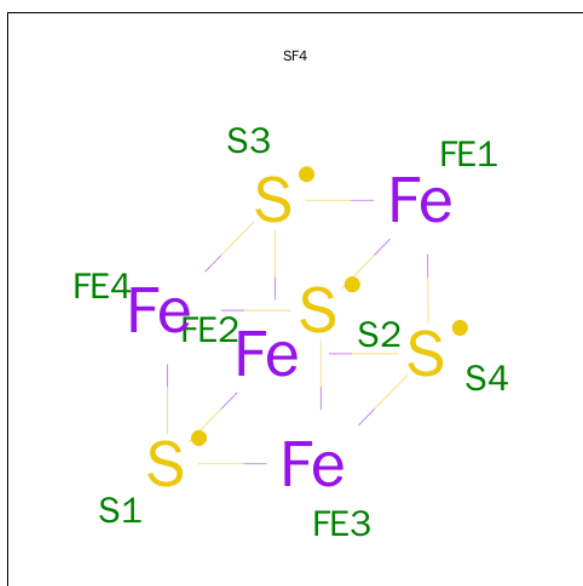
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
8	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
8	N	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 9 is FE2/S2 (INORGANIC) CLUSTER (three-letter code: FES) (formula: Fe_2S_2).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	B	1	Total	Fe	S	0	0
			4	2	2		
9	O	1	Total	Fe	S	0	0
			4	2	2		

- Molecule 10 is IRON/SULFUR CLUSTER (three-letter code: SF4) (formula: Fe_4S_4).



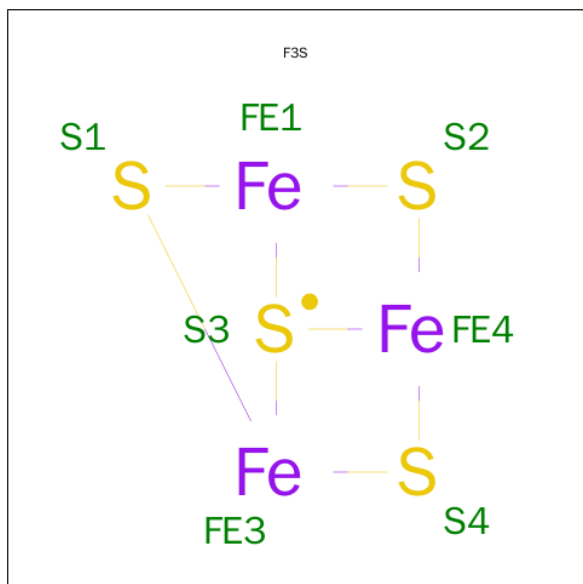
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
10	B	1	Total	Fe	S	0	0
			8	4	4		

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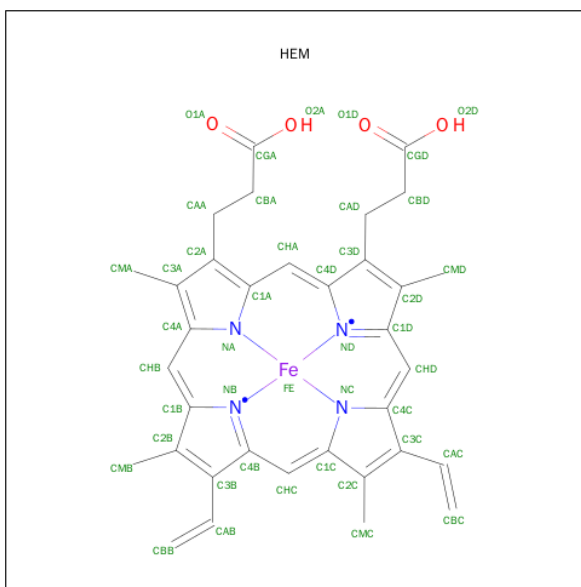
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
10	O	1	Total	Fe	S	0	0
			8	4	4		

- Molecule 11 is FE3-S4 CLUSTER (three-letter code: F3S) (formula: Fe_3S_4).



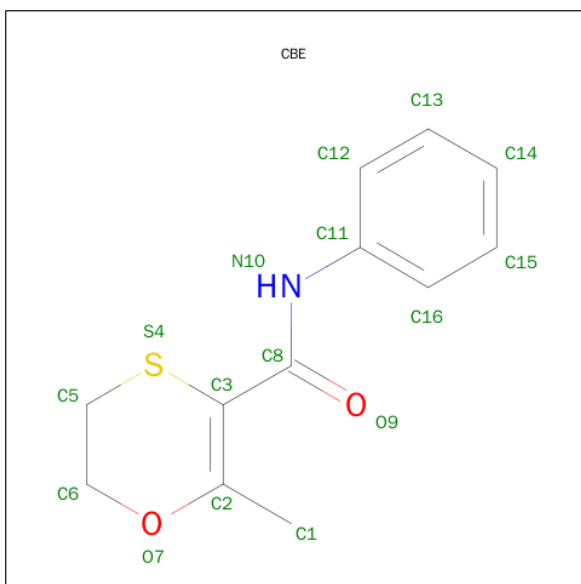
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
11	B	1	Total	Fe	S	0	0
			7	3	4		
11	O	1	Total	Fe	S	0	0
			7	3	4		

- Molecule 12 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
12	C	1	Total	C	Fe	N	O	
			41	32	1	4	4	
12	P	1	Total	C	Fe	N	O	
			41	32	1	4	4	

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



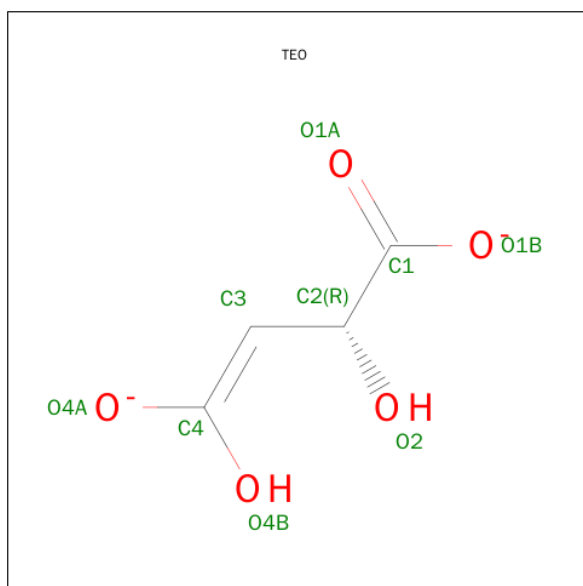
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
13	C	1	Total	C	N	O	S	
			16	12	1	2	1	

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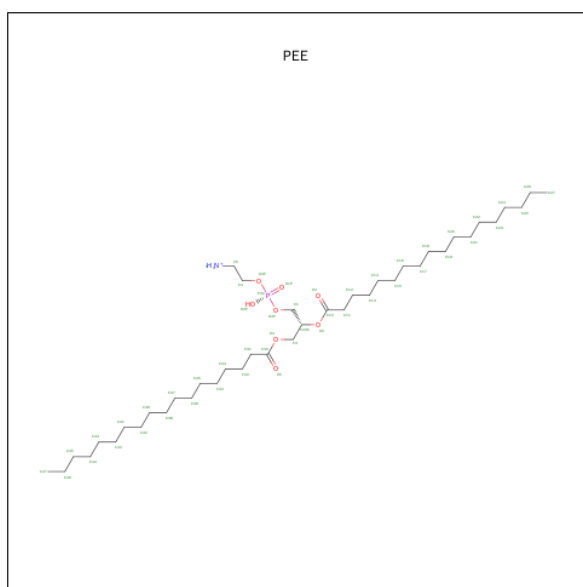
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
13	P	1	Total	C	N	O	S	0	0
			16	12	1	2	1		

- Molecule 14 is MALATE LIKE INTERMEDIATE (three-letter code: TEO) (formula: $C_4H_4O_5$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
14	A	1	Total	C	O	0	0
			9	4	5		
14	N	1	Total	C	O	0	0
			9	4	5		

- Molecule 15 is 1,2-DIOLEOYL-SN-GLYCERO-3-PHOSPHOETHANOLAMINE (three-letter code: PEE) (formula: $C_{41}H_{83}NO_8P$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
15	D	1	Total C 24 24	0	0
15	Q	1	Total C 24 24	0	0

- Molecule 16 is UNKNOWN LIGAND (three-letter code: UNL) (formula:).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
16	P	7	Total O 11 11	0	0
16	Q	6	Total O 6 6	0	0
16	D	9	Total O 9 9	0	0
16	B	10	Total O 14 14	0	0
16	C	15	Total O 22 22	0	0
16	A	21	Total O 29 29	0	0
16	N	21	Total O 24 24	0	0
16	O	6	Total O 10 10	0	0

- Molecule 17 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
17	C	1	Total	C	O	0	0
			6	3	3		
17	B	1	Total	C	O	0	0
			6	3	3		
17	O	1	Total	C	O	0	0
			6	3	3		
17	P	1	Total	C	O	0	0
			6	3	3		

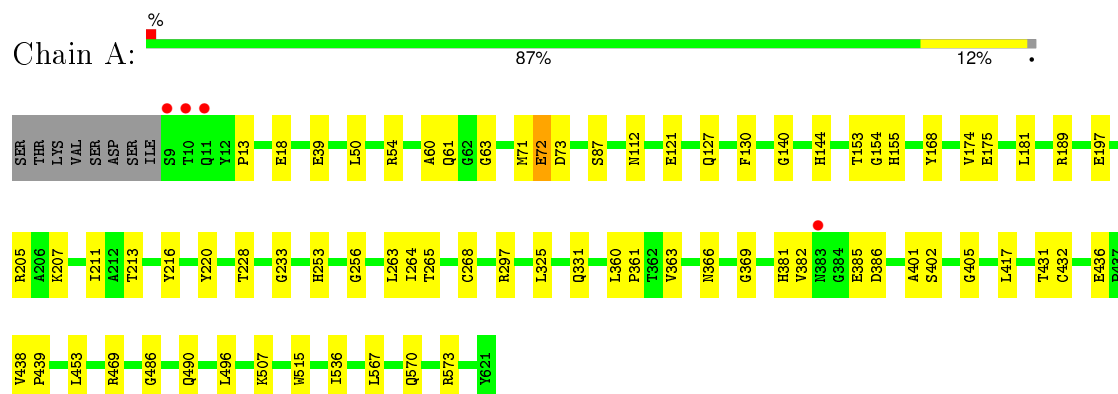
- Molecule 18 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
18	A	550	Total	O	0	0
			550	550		
18	B	299	Total	O	0	0
			299	299		
18	C	109	Total	O	0	0
			109	109		
18	D	57	Total	O	0	0
			57	57		
18	N	545	Total	O	0	0
			545	545		
18	O	285	Total	O	0	0
			285	285		
18	P	90	Total	O	0	0
			90	90		
18	Q	65	Total	O	0	0
			65	65		

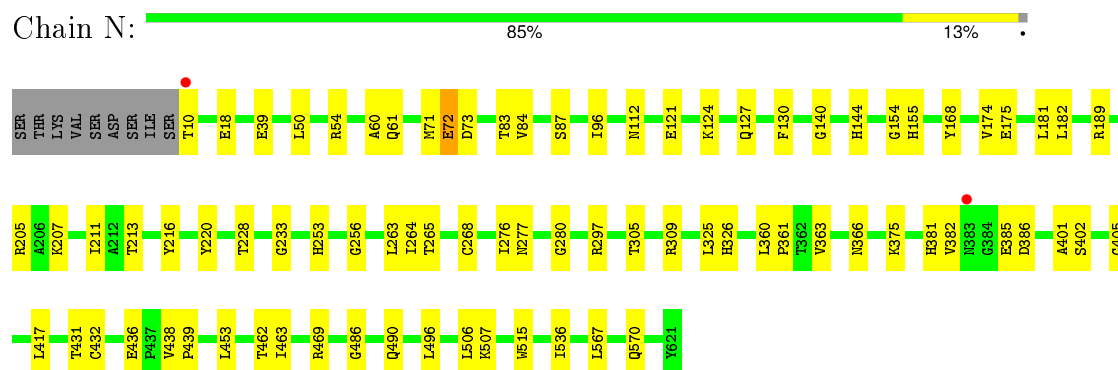
3 Residue-property plots

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.

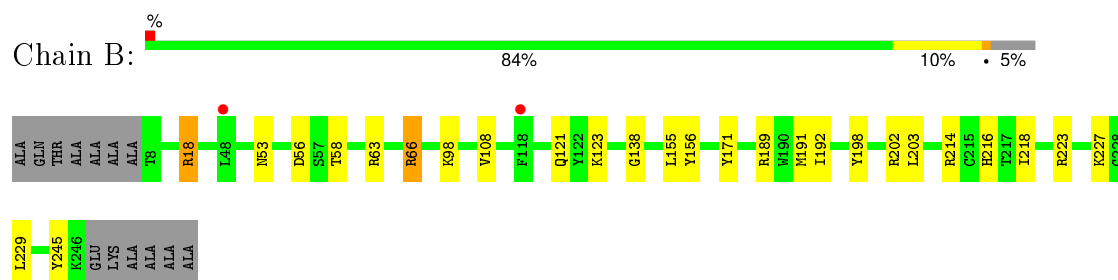
- Molecule 1: Succinate dehydrogenase flavoprotein subunit



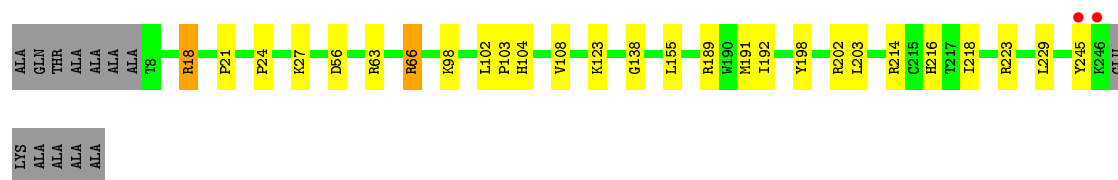
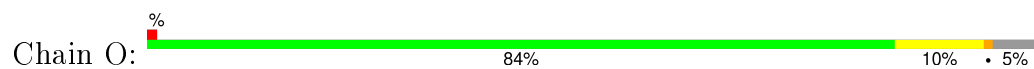
- Molecule 1: Succinate dehydrogenase flavoprotein subunit



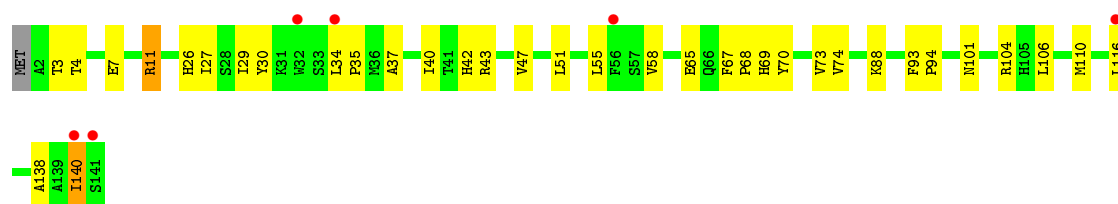
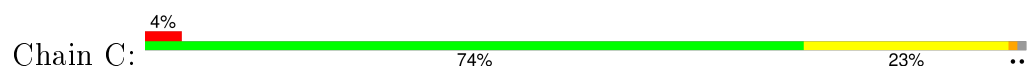
- Molecule 2: succinate dehydrogenase Ip subunit



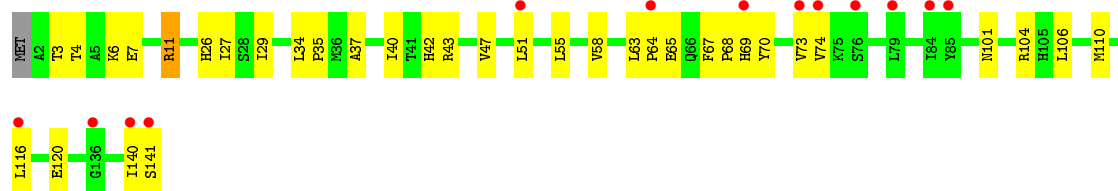
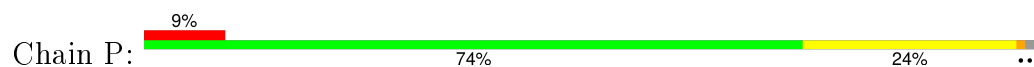
- Molecule 2: succinate dehydrogenase Ip subunit



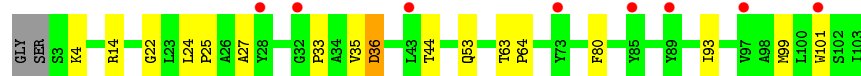
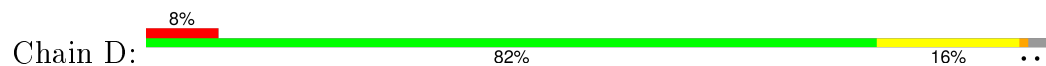
- Molecule 3: Succinate dehydrogenase cytochrome B, large subunit



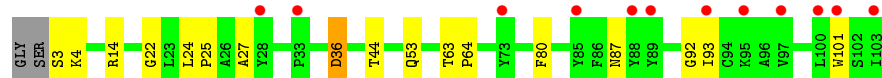
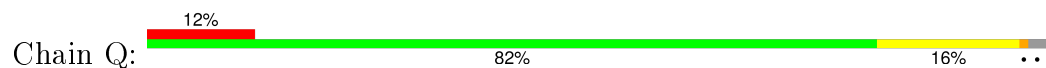
- Molecule 3: Succinate dehydrogenase cytochrome B, large subunit



- Molecule 4: Succinate dehydrogenase cytochrome B, small subunit



- Molecule 4: Succinate dehydrogenase cytochrome B, small subunit



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	118.70Å 200.75Å 67.63Å 90.00° 90.06° 90.00°	Depositor
Resolution (Å)	64.09 – 2.10 64.09 – 2.06	Depositor EDS
% Data completeness (in resolution range)	88.2 (64.09-2.10) 85.1 (64.09-2.06)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.19	Depositor
$\langle I/\sigma(I) \rangle$ ¹	7.62 (at 2.05Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.187 , 0.227 0.182 , 0.222	Depositor DCC
R_{free} test set	8009 reflections (5.19%)	DCC
Wilson B-factor (Å ²)	22.2	Xtriage
Anisotropy	0.525	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 61.3	EDS
Estimated twinning fraction	0.287 for -h,-k,l	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtriage
Outliers	1 of 166892 reflections (0.001%)	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	19494	wwPDB-VP
Average B, all atoms (Å ²)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.19% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: AZI, GOL, CBE, SF4, TEO, BHG, F3S, FES, PEE, HEM, UNL, K, 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	0.65	0/4832	0.81	5/6543 (0.1%)
1	N	0.66	0/4826	0.81	5/6535 (0.1%)
2	B	0.66	0/1959	0.81	2/2641 (0.1%)
2	O	0.64	0/1959	0.80	2/2641 (0.1%)
3	C	0.51	0/1107	0.61	0/1506
3	P	0.49	0/1107	0.60	0/1506
4	D	0.44	0/788	0.60	0/1082
4	Q	0.43	0/788	0.59	0/1082
All	All	0.62	0/17366	0.77	14/23536 (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
3	C	0	1

There are no bond length outliers.

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	18	ARG	NE-CZ-NH2	-8.27	116.17	120.30
1	N	469	ARG	NE-CZ-NH2	-7.86	116.37	120.30
2	O	18	ARG	NE-CZ-NH2	-7.81	116.39	120.30
1	A	469	ARG	NE-CZ-NH2	-6.79	116.91	120.30
2	O	18	ARG	NE-CZ-NH1	6.00	123.30	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
3	C	30	TYR	Sidechain

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	4731	0	4614	53	0
1	N	4725	0	4609	62	0
2	B	1918	0	1910	31	0
2	O	1918	0	1909	31	0
3	C	1078	0	1118	39	0
3	P	1078	0	1118	39	0
4	D	765	0	761	17	0
4	Q	765	0	761	14	0
5	C	18	0	24	0	0
5	P	18	0	24	0	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0
6	N	1	0	0	0	0
6	O	1	0	0	0	0
7	A	3	0	0	0	0
8	A	53	0	29	3	0
8	N	53	0	29	3	0
9	B	4	0	0	0	0
9	O	4	0	0	0	0
10	B	8	0	0	0	0
10	O	8	0	0	0	0
11	B	7	0	0	0	0
11	O	7	0	0	0	0
12	C	41	0	24	1	0
12	P	41	0	24	0	0
13	C	16	0	13	12	0
13	P	16	0	13	10	0
14	A	9	0	2	3	0
14	N	9	0	2	2	0
15	D	24	0	40	0	0
15	Q	24	0	40	2	0
16	A	29	0	0	7	0
16	B	14	0	0	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
16	C	22	0	0	4	0
16	D	9	0	0	0	0
16	N	24	0	0	2	0
16	O	10	0	0	3	0
16	P	11	0	0	2	0
16	Q	6	0	0	0	0
17	B	6	0	8	0	0
17	C	6	0	8	1	0
17	O	6	0	8	2	0
17	P	6	0	8	0	0
18	A	550	0	0	8	0
18	B	299	0	0	5	0
18	C	109	0	0	4	0
18	D	57	0	0	1	0
18	N	545	0	0	18	0
18	O	285	0	0	5	0
18	P	90	0	0	5	0
18	Q	65	0	0	1	0
All	All	19494	0	17096	289	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 8.

The worst 5 of 289 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)
13:C:144:CBE:O7	13:C:144:CBE:C2	1.73	1.36
13:P:202:CBE:C2	13:P:202:CBE:O7	1.73	1.34
13:C:144:CBE:O7	13:C:144:CBE:C6	1.81	1.26
13:P:202:CBE:C6	13:P:202:CBE:O7	1.82	1.26
16:B:1005:UNL:O5	16:B:1005:UNL:O6	1.55	1.25

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	611/621 (98%)	590 (97%)	21 (3%)	0	100	100
1	N	610/621 (98%)	590 (97%)	20 (3%)	0	100	100
2	B	237/252 (94%)	228 (96%)	8 (3%)	1 (0%)	39	37
2	O	237/252 (94%)	229 (97%)	7 (3%)	1 (0%)	39	37
3	C	138/141 (98%)	135 (98%)	2 (1%)	1 (1%)	26	21
3	P	138/141 (98%)	135 (98%)	2 (1%)	1 (1%)	26	21
4	D	99/103 (96%)	97 (98%)	2 (2%)	0	100	100
4	Q	99/103 (96%)	97 (98%)	2 (2%)	0	100	100
All	All	2169/2234 (97%)	2101 (97%)	64 (3%)	4 (0%)	52	53

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	66	ARG
2	O	66	ARG
3	C	140	ILE
3	P	140	ILE

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	498/506 (98%)	495 (99%)	3 (1%)	90	94
1	N	497/506 (98%)	493 (99%)	4 (1%)	86	91
2	B	214/219 (98%)	211 (99%)	3 (1%)	74	80
2	O	214/219 (98%)	211 (99%)	3 (1%)	74	80
3	C	118/119 (99%)	117 (99%)	1 (1%)	86	91
3	P	118/119 (99%)	117 (99%)	1 (1%)	86	91
4	D	78/79 (99%)	75 (96%)	3 (4%)	40	40

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
4	Q	78/79 (99%)	75 (96%)	3 (4%)	40	40
All	All	1815/1846 (98%)	1794 (99%)	21 (1%)	78	84

5 of 21 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	D	101	TRP
1	N	72	GLU
3	P	11	ARG
4	D	36	ASP
4	Q	14	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 34 such sidechains are listed below:

Mol	Chain	Res	Type
4	D	9	HIS
1	N	144	HIS
3	P	101	ASN
1	N	43	ASN
1	A	366	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 ⓘ

Of 122 ligands modelled in this entry, 95 are unknown and 4 are monoatomic - leaving 23 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$
8	FAD	A	1001	1	48,58,58	2.27	15 (31%)	54,89,89	2.77	15 (27%)
14	TEO	A	1002	-	0,8,8	0.00	-	1,10,10	6.30	1 (100%)
7	AZI	A	623	-	0,2,2	0.00	-	0,1,1	0.00	-
9	FES	B	1002	2	0,4,4	0.00	-	0,4,4	0.00	-
10	SF4	B	1003	2	0,12,12	0.00	-	0,24,24	0.00	-
11	F3S	B	1004	2	0,9,9	0.00	-	0,15,15	0.00	-
17	GOL	B	1010	-	5,5,5	1.05	0	5,5,5	0.57	0
5	BHG	C	142	-	18,18,18	1.85	5 (27%)	23,23,23	0.78	0
12	HEM	C	143	3,4	29,48,50	2.42	10 (34%)	24,80,82	2.47	8 (33%)
13	CBE	C	144	-	15,17,17	6.05	10 (66%)	17,22,22	2.29	3 (17%)
17	GOL	C	294	-	5,5,5	1.17	0	5,5,5	0.63	0
15	PEE	D	109	-	22,22,50	0.86	1 (4%)	20,20,55	0.97	2 (10%)
8	FAD	N	1001	1	48,58,58	2.27	15 (31%)	54,89,89	2.73	13 (24%)
14	TEO	N	1002	-	0,8,8	0.00	-	1,10,10	6.21	1 (100%)
9	FES	O	1002	2	0,4,4	0.00	-	0,4,4	0.00	-
10	SF4	O	1003	2	0,12,12	0.00	-	0,24,24	0.00	-
11	F3S	O	1004	2	0,9,9	0.00	-	0,15,15	0.00	-
17	GOL	O	1009	-	5,5,5	1.02	0	5,5,5	0.60	0
12	HEM	P	201	3,4	29,48,50	2.53	10 (34%)	24,80,82	2.49	8 (33%)
13	CBE	P	202	-	15,17,17	6.19	10 (66%)	17,22,22	2.24	3 (17%)
5	BHG	P	204	-	18,18,18	1.53	3 (16%)	23,23,23	0.68	0
17	GOL	P	208	-	5,5,5	1.23	0	5,5,5	0.65	0
15	PEE	Q	210	-	22,22,50	0.87	1 (4%)	20,20,55	0.95	2 (10%)

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
8	FAD	A	1001	1	-	0/30/50/50	0/6/6/6
14	TEO	A	1002	-	1/1/3/4	0/1/8/8	0/0/0/0

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
7	AZI	A	623	-	-	0/0/0/0	0/0/0/0
9	FES	B	1002	2	-	0/0/4/4	0/1/1/1
10	SF4	B	1003	2	-	0/0/48/48	0/6/5/5
11	F3S	B	1004	2	-	0/0/24/24	0/0/3/3
17	GOL	B	1010	-	-	0/4/4/4	0/0/0/0
5	BHG	C	142	-	1/1/5/5	0/9/29/29	0/1/1/1
12	HEM	C	143	3,4	-	0/6/50/54	0/0/8/8
13	CBE	C	144	-	-	0/6/19/19	0/1/2/2
17	GOL	C	294	-	-	0/4/4/4	0/0/0/0
15	PEE	D	109	-	-	0/18/18/54	0/0/0/0
8	FAD	N	1001	1	-	0/30/50/50	0/6/6/6
14	TEO	N	1002	-	1/1/3/4	0/1/8/8	0/0/0/0
9	FES	O	1002	2	-	0/0/4/4	0/1/1/1
10	SF4	O	1003	2	-	0/0/48/48	0/6/5/5
11	F3S	O	1004	2	-	0/0/24/24	0/0/3/3
17	GOL	O	1009	-	-	0/4/4/4	0/0/0/0
12	HEM	P	201	3,4	-	0/6/50/54	0/0/8/8
13	CBE	P	202	-	-	0/6/19/19	0/1/2/2
5	BHG	P	204	-	1/1/5/5	0/9/29/29	0/1/1/1
17	GOL	P	208	-	-	0/4/4/4	0/0/0/0
15	PEE	Q	210	-	-	0/18/18/54	0/0/0/0

The worst 5 of 80 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
13	P	202	CBE	C3-S4	-18.28	1.39	1.74
13	C	144	CBE	C3-S4	-17.73	1.40	1.74
13	P	202	CBE	C5-S4	-8.79	1.45	1.80
13	C	144	CBE	C5-S4	-8.77	1.45	1.80
12	P	201	HEM	C2D-C3D	-6.17	1.36	1.54

The worst 5 of 56 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	A	1001	FAD	N3A-C2A-N1A	-12.50	119.32	128.89
8	N	1001	FAD	N3A-C2A-N1A	-12.22	119.54	128.89
8	N	1001	FAD	C4X-C10-N10	-6.27	116.82	120.52
8	A	1001	FAD	C4X-C10-N10	-6.03	116.97	120.52
8	A	1001	FAD	C4-C4X-C10	-4.97	116.76	119.94

All (4) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
5	C	142	BHG	C4
14	A	1002	TEO	C2
5	P	204	BHG	C4
14	N	1002	TEO	C2

There are no torsion outliers.

There are no ring outliers.

10 monomers are involved in 39 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	A	1001	FAD	3	0
14	A	1002	TEO	3	0
12	C	143	HEM	1	0
13	C	144	CBE	12	0
17	C	294	GOL	1	0
8	N	1001	FAD	3	0
14	N	1002	TEO	2	0
17	O	1009	GOL	2	0
13	P	202	CBE	10	0
15	Q	210	PEE	2	0

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 ⓘ

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	613/621 (98%)	-0.07	4 (0%) 89 91	11, 23, 45, 85	0
1	N	612/621 (98%)	-0.06	2 (0%) 94 95	10, 22, 42, 81	0
2	B	239/252 (94%)	-0.09	2 (0%) 87 90	15, 22, 38, 67	0
2	O	239/252 (94%)	-0.10	2 (0%) 87 90	13, 22, 37, 68	0
3	C	140/141 (99%)	0.21	6 (4%) 39 48	19, 34, 52, 75	0
3	P	140/141 (99%)	0.49	13 (9%) 11 15	18, 37, 77, 87	0
4	D	101/103 (98%)	0.53	8 (7%) 15 21	21, 41, 59, 62	0
4	Q	101/103 (98%)	0.79	12 (11%) 6 8	26, 47, 67, 75	0
All	All	2185/2234 (97%)	0.05	49 (2%) 65 71	10, 24, 53, 87	0

The worst 5 of 49 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	N	10	THR	9.1
3	P	140	ILE	8.2
3	P	141	SER	8.1
4	Q	93	ILE	6.6
3	C	140	ILE	6.2

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, 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	LLDF	B-factors(Å ²)	Q<0.9
16	UNL	C	214	5/-	0.63	0.48	24.12	90,91,92,93	0
17	GOL	P	208	6/6	0.32	1.66	15.84	155,156,156,157	0
17	GOL	C	294	6/6	0.84	0.85	10.38	132,132,133,133	0
17	GOL	O	1009	6/6	0.90	0.19	8.79	29,30,33,33	0
16	UNL	P	211	5/-	0.47	0.92	6.44	119,119,120,121	0
16	UNL	C	272	1/-	0.91	0.19	4.28	54,54,54,54	0
15	PEE	D	109	24/51	0.62	0.53	3.60	48,64,74,75	0
5	BHG	C	142	18/18	0.81	0.34	3.00	49,67,79,79	0
15	PEE	Q	210	24/51	0.58	0.61	2.75	70,82,95,95	0
13	CBE	C	144	16/16	0.75	0.25	2.64	23,29,37,46	0
11	F3S	O	1004	7/7	0.99	0.14	2.55	15,20,22,22	0
17	GOL	B	1010	6/6	0.96	0.13	2.13	26,29,32,32	0
13	CBE	P	202	16/16	0.89	0.21	2.10	21,30,36,49	0
16	UNL	A	1020	1/-	0.94	0.28	1.83	34,34,34,34	0
5	BHG	P	204	18/18	0.91	0.18	1.60	38,45,58,59	0
14	TEO	N	1002	9/9	0.95	0.12	1.54	13,17,22,23	0
8	FAD	N	1001	53/53	0.97	0.12	1.20	4,13,21,24	0
16	UNL	N	1015	1/-	0.93	0.19	1.02	42,42,42,42	0
8	FAD	A	1001	53/53	0.97	0.12	0.69	9,14,22,25	0
16	UNL	N	1003	4/-	0.87	0.15	0.55	57,58,59,59	0
14	TEO	A	1002	9/9	0.96	0.11	0.12	19,21,24,26	0
12	HEM	P	201	41/43	0.97	0.13	-0.06	29,32,43,48	0
10	SF4	O	1003	8/8	0.99	0.12	-0.17	14,18,20,20	0
12	HEM	C	143	41/43	0.98	0.12	-0.26	23,32,40,49	0
11	F3S	B	1004	7/7	0.99	0.11	-0.27	17,19,20,25	0
9	FES	B	1002	4/4	0.99	0.12	-0.38	14,16,16,17	0
9	FES	O	1002	4/4	0.99	0.11	-0.48	14,16,16,19	0
6	K	N	622	1/1	0.99	0.10	-0.59	19,19,19,19	0
10	SF4	B	1003	8/8	0.99	0.10	-0.63	16,17,19,21	0
6	K	A	622	1/1	0.99	0.09	-1.35	24,24,24,24	0
6	K	B	253	1/1	0.99	0.07	-1.87	38,38,38,38	0
6	K	O	253	1/1	0.96	0.08	-1.91	39,39,39,39	0
16	UNL	D	247	1/-	0.74	0.17	-	68,68,68,68	0
16	UNL	Q	288	1/-	0.80	0.25	-	44,44,44,44	0
16	UNL	P	274	1/-	0.78	0.24	-	56,56,56,56	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors(\AA^2)	Q<0.9
16	UNL	A	1008	1/-	0.81	1.06	-	62,62,62,62	0
16	UNL	N	1019	1/-	0.92	0.24	-	49,49,49,49	0
16	UNL	A	1007	1/-	0.61	0.25	-	66,66,66,66	0
16	UNL	N	1016	1/-	0.55	0.21	-	62,62,62,62	0
16	UNL	N	1014	1/-	0.35	0.34	-	76,76,76,76	0
16	UNL	C	293	1/-	0.73	0.27	-	62,62,62,62	0
16	UNL	N	1013	1/-	0.78	0.28	-	57,57,57,57	0
16	UNL	N	1023	1/-	0.71	0.15	-	45,45,45,45	0
16	UNL	C	259	1/-	0.35	0.25	-	64,64,64,64	0
16	UNL	P	233	1/-	0.82	0.21	-	44,44,44,44	0
16	UNL	B	1006	1/-	0.47	0.60	-	76,76,76,76	0
16	UNL	Q	219	1/-	0.93	0.17	-	45,45,45,45	0
16	UNL	O	276	1/-	0.52	0.26	-	65,65,65,65	0
16	UNL	C	145	4/-	0.87	0.11	-	70,70,70,70	0
16	UNL	N	1010	1/-	0.91	0.22	-	63,63,63,63	0
16	UNL	A	1005	1/-	0.32	0.76	-	66,66,66,66	0
16	UNL	C	292	1/-	0.70	0.30	-	64,64,64,64	0
16	UNL	D	245	1/-	0.88	0.15	-	58,58,58,58	0
16	UNL	O	1008	1/-	0.86	0.29	-	47,47,47,47	0
16	UNL	Q	221	1/-	0.84	0.17	-	56,56,56,56	0
16	UNL	A	1003	6/-	0.67	0.30	-	135,136,136,137	0
16	UNL	N	1011	1/-	0.91	0.14	-	38,38,38,38	0
16	UNL	A	1014	1/-	0.84	0.23	-	47,47,47,47	0
16	UNL	C	240	1/-	0.93	0.20	-	45,45,45,45	0
16	UNL	B	258	1/-	0.84	0.21	-	57,57,57,57	0
16	UNL	A	1018	1/-	0.91	0.23	-	45,45,45,45	0
16	UNL	P	285	1/-	0.82	0.17	-	50,50,50,50	0
16	UNL	D	265	1/-	0.61	0.71	-	103,103,103,103	0
16	UNL	P	236	1/-	0.90	0.16	-	53,53,53,53	0
16	UNL	C	254	1/-	0.68	0.18	-	55,55,55,55	0
16	UNL	A	1012	1/-	0.80	0.38	-	69,69,69,69	0
16	UNL	Q	234	1/-	0.88	0.40	-	53,53,53,53	0
16	UNL	A	1010	1/-	0.67	0.37	-	67,67,67,67	0
16	UNL	C	256	1/-	0.87	0.19	-	61,61,61,61	0
16	UNL	B	1005	5/-	0.60	0.40	-	92,93,93,94	0
16	UNL	B	268	1/-	0.76	0.21	-	51,51,51,51	0
16	UNL	N	1007	1/-	0.80	0.19	-	59,59,59,59	0
16	UNL	O	282	1/-	0.77	0.17	-	52,52,52,52	0
16	UNL	O	1005	5/-	0.70	0.38	-	146,146,147,147	0
16	UNL	B	297	1/-	0.85	0.38	-	51,51,51,51	0
16	UNL	A	1021	1/-	0.88	0.16	-	37,37,37,37	0
16	UNL	A	1013	1/-	0.85	0.12	-	39,39,39,39	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors(\AA^2)	Q<0.9
16	UNL	N	1009	1/-	0.81	0.19	-	50,50,50,50	0
16	UNL	A	1004	4/-	0.74	0.21	-	55,60,60,61	0
16	UNL	O	1007	1/-	0.84	0.15	-	69,69,69,69	0
16	UNL	N	1020	1/-	0.85	0.13	-	56,56,56,56	0
16	UNL	C	248	1/-	0.59	0.52	-	57,57,57,57	0
16	UNL	N	1008	1/-	0.90	0.14	-	39,39,39,39	0
16	UNL	D	263	1/-	0.78	0.25	-	53,53,53,53	0
16	UNL	A	1006	1/-	0.92	0.10	-	47,47,47,47	0
16	UNL	N	1005	1/-	0.10	0.88	-	76,76,76,76	0
16	UNL	C	289	1/-	0.86	0.15	-	57,57,57,57	0
16	UNL	C	251	1/-	0.83	0.32	-	53,53,53,53	0
16	UNL	N	1004	1/-	0.90	0.17	-	45,45,45,45	0
16	UNL	A	1019	1/-	0.94	0.24	-	37,37,37,37	0
16	UNL	Q	237	1/-	0.82	0.23	-	47,47,47,47	0
16	UNL	B	280	1/-	0.84	0.15	-	53,53,53,53	0
16	UNL	D	250	1/-	0.92	0.19	-	53,53,53,53	0
16	UNL	N	1022	1/-	0.48	0.39	-	72,72,72,72	0
16	UNL	A	1017	1/-	0.93	0.17	-	48,48,48,48	0
16	UNL	B	1007	1/-	0.17	1.00	-	74,74,74,74	0
16	UNL	N	1021	1/-	0.79	0.18	-	42,42,42,42	0
16	UNL	A	1011	1/-	0.80	0.24	-	55,55,55,55	0
16	UNL	C	267	1/-	0.89	0.21	-	52,52,52,52	0
16	UNL	O	1006	1/-	0.86	0.20	-	66,66,66,66	0
16	UNL	N	1006	1/-	0.61	0.28	-	52,52,52,52	0
16	UNL	A	1015	1/-	0.66	0.51	-	69,69,69,69	0
16	UNL	D	255	1/-	0.95	0.07	-	35,35,35,35	0
16	UNL	D	266	1/-	0.63	0.32	-	62,62,62,62	0
16	UNL	D	291	1/-	0.75	0.17	-	58,58,58,58	0
16	UNL	A	1022	1/-	0.58	0.27	-	51,51,51,51	0
16	UNL	N	1017	1/-	0.92	0.12	-	30,30,30,30	0
16	UNL	P	218	1/-	0.90	0.16	-	57,57,57,57	0
16	UNL	P	224	1/-	0.47	0.29	-	71,71,71,71	0
16	UNL	A	1016	1/-	0.80	0.38	-	50,50,50,50	0
16	UNL	B	277	1/-	0.77	0.18	-	46,46,46,46	0
16	UNL	C	235	1/-	0.66	0.23	-	71,71,71,71	0
16	UNL	B	1009	1/-	0.69	0.26	-	73,73,73,73	0
16	UNL	A	1009	1/-	0.84	0.37	-	50,50,50,50	0
16	UNL	B	1008	1/-	0.88	0.44	-	61,61,61,61	0
7	AZI	A	623	3/3	0.81	0.18	-	56,56,64,64	0
16	UNL	Q	287	1/-	0.21	0.50	-	75,75,75,75	0
16	UNL	D	262	1/-	0.81	0.21	-	59,59,59,59	0
16	UNL	C	241	1/-	0.92	0.15	-	61,61,61,61	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors(\AA^2)	Q<0.9
16	UNL	A	1023	1/-	0.70	0.28	-	53,53,53,53	0
16	UNL	N	1012	1/-	0.15	0.99	-	94,94,94,94	0
16	UNL	N	1018	1/-	0.71	0.21	-	46,46,46,46	0

6.5 Other polymers [i](#)

There are no such residues in this entry.