Full wwPDB X-ray Structure Validation Report ⓘ

Feb 4, 2024 – 07:02 AM EST

PDB ID	:	1QCR
Title	:	CRYSTAL STRUCTURE OF BOVINE MITOCHONDRIAL CYTOCHROME BC1 COMPLEX, ALPHA CARBON ATOMS ONLY
Authors	:	Xia, D.; Yu, C.A.; Kim, H.; Xia, J.Z.; Kachurin, A.; Zhang, L.; Yu, L.; Deisenhofer, J.
Deposited on	:	1997-05-17
Resolution	:	2.70 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 ⓘ 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 ⓘ) were used in the production of this report:

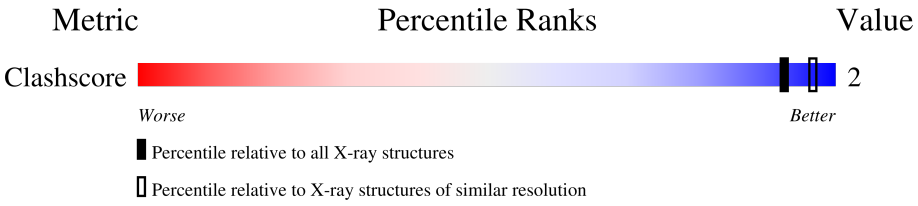
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 2.70 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))
Clashscore	141614	3122 (2.70-2.70)

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%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	446	100%
2	B	423	100%
3	C	378	100%
4	D	75	100%
5	E	196	100%
6	F	103	100%
7	G	70	100%
8	H	60	100%
9	I	28	100%
10	J	59	100%

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Mol	Chain	Length	Quality of chain
11	K	45	100%

2 Entry composition (i)

There are 12 unique types of molecules in this entry. The entry contains 1926 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 UBIQUINOL CYTOCHROME C OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
1	A	446	Total C 446 446	0	0	446

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	428	VAL	ILE	conflict	UNP P31800

- Molecule 2 is a protein called UBIQUINOL CYTOCHROME C OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
2	B	423	Total C 423 423	0	0	423

- Molecule 3 is a protein called UBIQUINOL CYTOCHROME C OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
3	C	378	Total C 378 378	0	0	378

- Molecule 4 is a protein called UBIQUINOL CYTOCHROME C OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
4	D	75	Total C 75 75	0	0	75

- Molecule 5 is a protein called UBIQUINOL CYTOCHROME C OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
5	E	196	Total C 196 196	0	0	196

- Molecule 6 is a protein called UBIQUINOL CYTOCHROME C OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
6	F	103	Total C 103 103	0	0	103

- Molecule 7 is a protein called UBIQUINOL CYTOCHROME C OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
7	G	70	Total C 70 70	0	0	70

- Molecule 8 is a protein called UBIQUINOL CYTOCHROME C OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
8	H	60	Total C 60 60	0	0	60

- Molecule 9 is a protein called UBIQUINOL CYTOCHROME C OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
9	I	28	Total C 28 28	0	0	28

- Molecule 10 is a protein called UBIQUINOL CYTOCHROME C OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
10	J	59	Total C 59 59	0	0	59

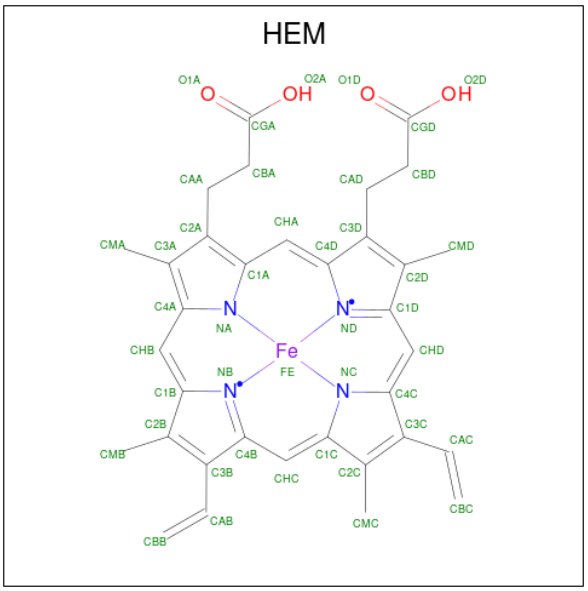
There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
J	37	ASN	GLN	conflict	UNP P00130

- Molecule 11 is a protein called UBIQUINOL CYTOCHROME C OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
11	K	45	Total C 45 45	0	0	45

- Molecule 12 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



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

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. 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. 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.

Note EDS was not executed.

• Molecule 1: UBIQUINOL CYTOCHROME C OXIDOREDUCTASE

Chain A: 100%

• Molecule 2: UBIQUINOL CYTOCHROME C OXIDOREDUCTASE

Chain B: 100%

There are no outlier residues recorded for this chain.

• Molecule 3: UBIQUINOL CYTOCHROME C OXIDOREDUCTASE

Chain C: 100%

There are no outlier residues recorded for this chain.

• Molecule 4: UBIQUINOL CYTOCHROME C OXIDOREDUCTASE

Chain D: 100%

There are no outlier residues recorded for this chain.

• Molecule 5: UBIQUINOL CYTOCHROME C OXIDOREDUCTASE

Chain E: 100%

There are no outlier residues recorded for this chain.

• Molecule 6: UBIQUINOL CYTOCHROME C OXIDOREDUCTASE

Chain F: 100%

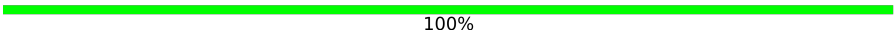
There are no outlier residues recorded for this chain.

• Molecule 7: UBIQUINOL CYTOCHROME C OXIDOREDUCTASE

Chain G: 100%

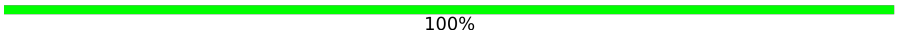
There are no outlier residues recorded for this chain.

• Molecule 8: UBIQUINOL CYTOCHROME C OXIDOREDUCTASE

Chain H: 

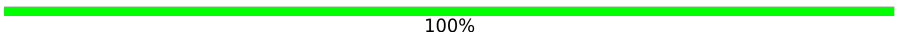
There are no outlier residues recorded for this chain.

• Molecule 9: UBIQUINOL CYTOCHROME C OXIDOREDUCTASE

Chain I: 

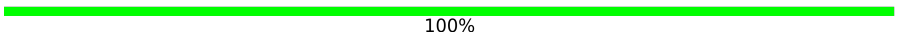
There are no outlier residues recorded for this chain.

• Molecule 10: UBIQUINOL CYTOCHROME C OXIDOREDUCTASE

Chain J: 

There are no outlier residues recorded for this chain.

• Molecule 11: UBIQUINOL CYTOCHROME C OXIDOREDUCTASE

Chain K: 

There are no outlier residues recorded for this chain.

4 Data and refinement statistics (i)

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	I 41 2 2	Depositor
Cell constants a, b, c, α, β, γ	153.50Å 153.50Å 597.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 2.70	Depositor
% Data completeness (in resolution range)	90.6 (10.00-2.70)	Depositor
R_{merge}	0.14	Depositor
R_{sym}	0.14	Depositor
Refinement program	X-PLOR 3.851	Depositor
R, R_{free}	0.300 , 0.375	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	1926	wwPDB-VP
Average B, all atoms (Å^2)	65.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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

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).

There are no protein, RNA or DNA chains available to summarize Z scores of covalent bonds and angles.

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	446	0	0	1	0
2	B	423	0	0	0	0
3	C	378	0	0	0	0
4	D	75	0	0	0	0
5	E	196	0	0	0	0
6	F	103	0	0	0	0
7	G	70	0	0	0	0
8	H	60	0	0	0	0
9	I	28	0	0	0	0
10	J	59	0	0	0	0
11	K	45	0	0	0	0
12	C	43	0	30	2	0
All	All	1926	0	30	3	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 2.

All (3) 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)
12:C:609:HEM:HHA	12:C:609:HEM:HBD1	1.76	0.68
12:C:609:HEM:HHA	12:C:609:HEM:HBA1	1.77	0.67
1:A:66:GLY:CA	1:A:72:GLY:CA	2.77	0.62

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

There are no protein backbone outliers to report in this entry.

5.3.2 Protein sidechains

There are no protein residues with a non-rotameric sidechain to report in this entry.

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 monosaccharides in this entry.

5.6 Ligand geometry

1 ligand is modelled in this entry.

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	$\#\|Z\| > 2$
12	HEM	C	609	-	41,50,50	2.40	16 (39%)	45,82,82	2.19	16 (35%)

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
12	HEM	C	609	-	-	8/12/54/54	-

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
12	C	609	HEM	C2C-C1C	6.35	1.56	1.42
12	C	609	HEM	C3C-C2C	-5.71	1.32	1.40
12	C	609	HEM	C4D-C3D	4.62	1.53	1.45
12	C	609	HEM	CBB-CAB	4.45	1.52	1.30
12	C	609	HEM	C3C-CAC	-4.28	1.39	1.47
12	C	609	HEM	C1B-NB	3.41	1.46	1.40
12	C	609	HEM	CBC-CAC	3.39	1.51	1.29
12	C	609	HEM	CHB-C1B	3.13	1.43	1.35
12	C	609	HEM	CMD-C2D	2.89	1.56	1.50
12	C	609	HEM	C1D-ND	2.76	1.44	1.38
12	C	609	HEM	CAB-C3B	-2.69	1.40	1.47
12	C	609	HEM	C4A-CHB	2.58	1.48	1.41
12	C	609	HEM	C1D-C2D	2.44	1.49	1.44
12	C	609	HEM	C4A-NA	2.41	1.41	1.36
12	C	609	HEM	C1B-C2B	2.09	1.48	1.44
12	C	609	HEM	C2A-C3A	-2.02	1.31	1.37

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
12	C	609	HEM	C4D-ND-C1D	-5.18	99.72	105.07
12	C	609	HEM	CMB-C2B-C1B	4.88	132.47	125.04
12	C	609	HEM	CHA-C4D-ND	-4.77	118.48	124.38
12	C	609	HEM	CAD-C3D-C4D	4.21	132.01	124.66
12	C	609	HEM	CBD-CAD-C3D	-3.51	102.86	112.63

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
12	C	609	HEM	CHB-C1B-NB	-3.38	120.20	124.38
12	C	609	HEM	C2D-C1D-ND	3.22	113.74	109.88
12	C	609	HEM	C3D-C4D-ND	3.16	113.69	110.17
12	C	609	HEM	CAD-C3D-C2D	-2.99	122.31	127.88
12	C	609	HEM	CMB-C2B-C3B	-2.90	121.21	128.30
12	C	609	HEM	CBA-CAA-C2A	2.77	117.34	112.62
12	C	609	HEM	CHD-C1D-C2D	-2.73	120.71	124.98
12	C	609	HEM	C1B-NB-C4B	-2.35	102.64	105.07
12	C	609	HEM	C4B-CHC-C1C	2.26	125.55	122.56
12	C	609	HEM	C3B-C2B-C1B	-2.21	104.85	106.49
12	C	609	HEM	CHC-C4B-C3B	-2.00	121.51	124.57

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
12	C	609	HEM	C3A-C2A-CAA-CBA
12	C	609	HEM	C4D-C3D-CAD-CBD
12	C	609	HEM	C2D-C3D-CAD-CBD
12	C	609	HEM	C1A-C2A-CAA-CBA
12	C	609	HEM	CAD-CBD-CGD-O1D
12	C	609	HEM	CAD-CBD-CGD-O2D
12	C	609	HEM	CAA-CBA-CGA-O2A
12	C	609	HEM	CAA-CBA-CGA-O1A

There are no ring outliers.

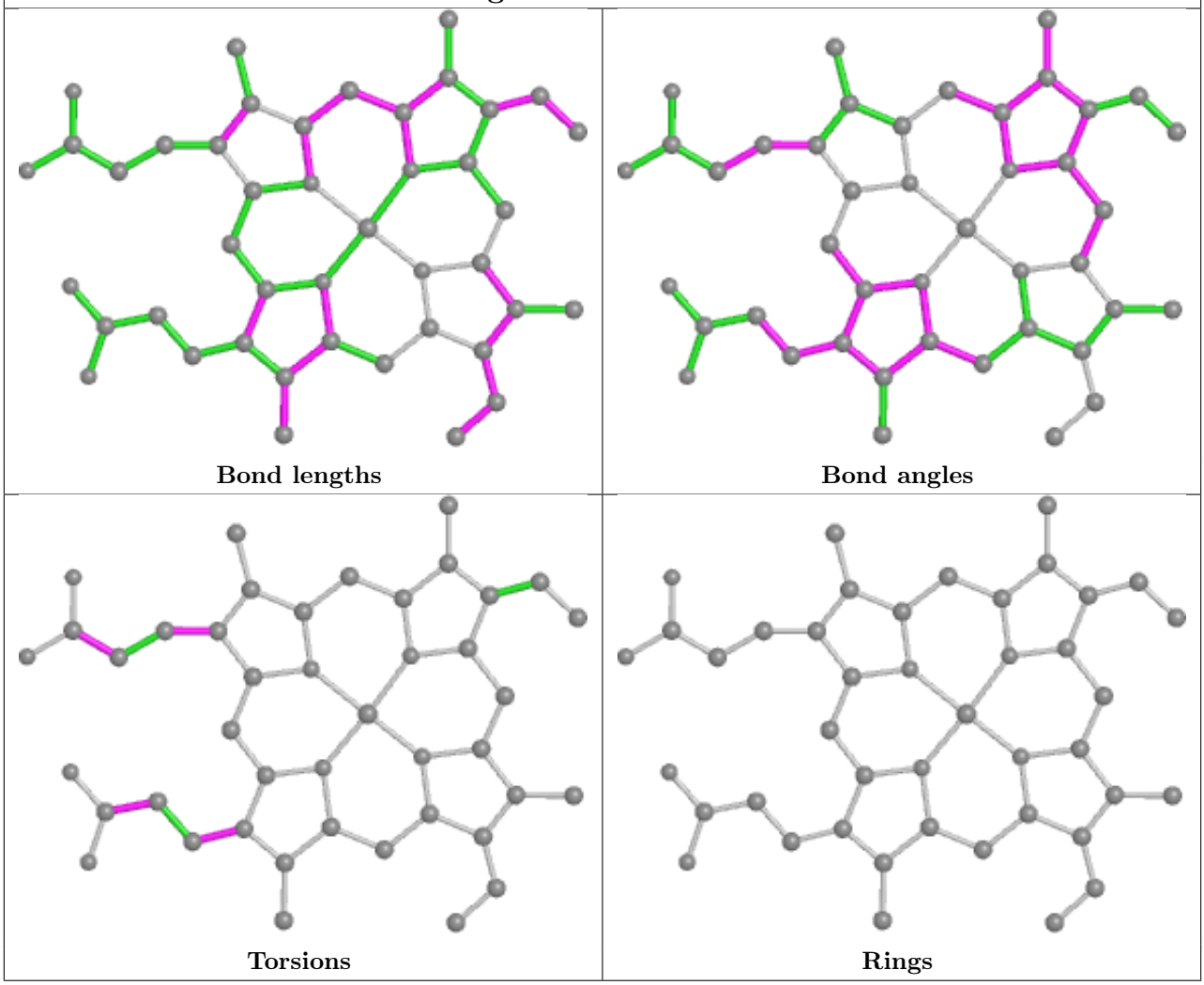
1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
12	C	609	HEM	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient

equivalents in the CSD to analyse the geometry.

Ligand HEM C 609



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

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.