



Full wwPDB X-ray Structure Validation Report ⓘ

May 28, 2020 – 08:00 pm BST

PDB ID : 1N0J
Title : The Structure of Human Mitochondrial MN3+ Superoxide Dismutase Reveals a Novel Tetrameric Interface of Two 4-Helix Bundles
Authors : Borgstahl, G.E.O.; Parge, H.E.; Tainer, J.A.
Deposited on : 2002-10-14
Resolution : 2.20 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Xtriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
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) : 2.11

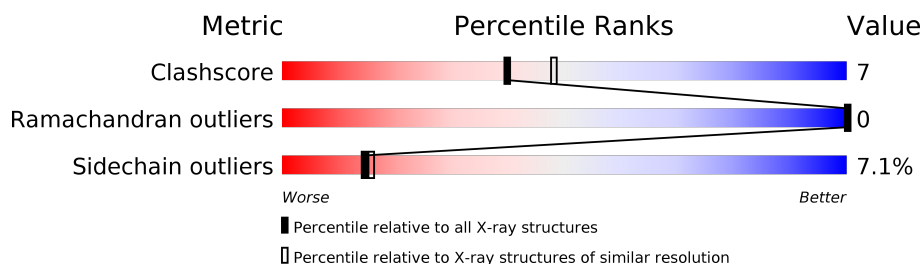
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)

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 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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	199	
1	B	199	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3317 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 Superoxide dismutase [Mn].

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	198	Total	C	N	O	S	0	0	0
			1573	1008	275	286	4			
1	B	198	Total	C	N	O	S	0	0	0
			1573	1008	275	286	4			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	EXPRESSION TAG	UNP P04179
B	0	MET	-	EXPRESSION TAG	UNP P04179

- Molecule 2 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

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

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	95	Total	O	0	0
			95	95		
3	B	74	Total	O	0	0
			74	74		

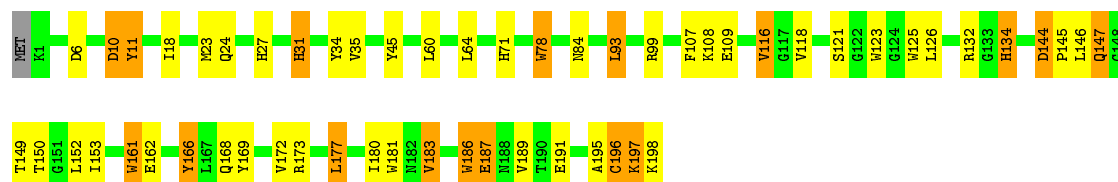
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of 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.

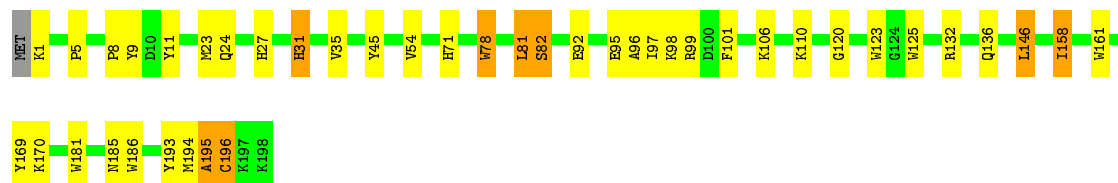
• Molecule 1: Superoxide dismutase [Mn]

Chain A: 



• Molecule 1: Superoxide dismutase [Mn]

Chain B: 



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	76.13 Å 79.90 Å 68.05 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 2.20	Depositor
% Data completeness (in resolution range)	(Not available) (10.00-2.20)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 20	Depositor
R, R_{free}	0.171 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3317	wwPDB-VP
Average B, all atoms (Å ²)	25.0	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: MN

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	1.27	4/1619 (0.2%)	1.75	43/2197 (2.0%)
1	B	1.07	4/1619 (0.2%)	1.72	32/2197 (1.5%)
All	All	1.18	8/3238 (0.2%)	1.73	75/4394 (1.7%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
1	B	0	2
All	All	0	3

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	196	CYS	C-N	-23.37	0.80	1.34
1	A	196	CYS	N-CA	-14.73	1.16	1.46
1	B	196	CYS	N-CA	-11.75	1.22	1.46
1	A	195	ALA	C-N	-9.88	1.11	1.34
1	A	196	CYS	C-O	-9.07	1.06	1.23
1	B	196	CYS	C-O	7.70	1.38	1.23
1	B	195	ALA	C-N	-7.12	1.17	1.34
1	B	196	CYS	C-N	6.25	1.48	1.34

All (75) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	195	ALA	O-C-N	-15.15	98.46	122.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	23	MET	CG-SD-CE	-13.41	78.75	100.20
1	B	195	ALA	CA-C-N	12.33	144.32	117.20
1	A	196	CYS	N-CA-CB	11.24	130.83	110.60
1	B	169	TYR	CB-CG-CD2	-10.60	114.64	121.00
1	A	195	ALA	O-C-N	-9.84	106.96	122.70
1	A	78	TRP	CD1-CG-CD2	9.05	113.54	106.30
1	B	181	TRP	CD1-CG-CD2	8.83	113.36	106.30
1	A	45	TYR	CB-CG-CD1	-8.81	115.71	121.00
1	A	181	TRP	CG-CD2-CE3	8.71	141.74	133.90
1	B	181	TRP	CE2-CD2-CG	-8.50	100.50	107.30
1	B	45	TYR	CB-CG-CD1	-8.42	115.95	121.00
1	B	9	TYR	CB-CG-CD1	-8.40	115.96	121.00
1	A	186	TRP	CD1-CG-CD2	8.26	112.91	106.30
1	B	78	TRP	CD1-CG-CD2	8.11	112.79	106.30
1	A	132	ARG	NE-CZ-NH2	-7.97	116.32	120.30
1	B	161	TRP	CD1-CG-CD2	7.90	112.62	106.30
1	B	125	TRP	CD1-CG-CD2	7.85	112.58	106.30
1	B	196	CYS	N-CA-C	7.79	132.04	111.00
1	A	78	TRP	CE2-CD2-CG	-7.75	101.10	107.30
1	A	78	TRP	CB-CG-CD1	-7.68	117.02	127.00
1	B	78	TRP	CE2-CD2-CG	-7.67	101.16	107.30
1	A	195	ALA	CA-C-N	7.49	133.69	117.20
1	B	78	TRP	CG-CD2-CE3	7.32	140.49	133.90
1	A	169	TYR	CB-CG-CD2	-7.24	116.66	121.00
1	B	78	TRP	CB-CG-CD1	-7.13	117.73	127.00
1	A	181	TRP	CE2-CD2-CG	-7.04	101.67	107.30
1	A	186	TRP	CE2-CD2-CG	-6.90	101.78	107.30
1	B	195	ALA	C-N-CA	6.86	138.84	121.70
1	B	186	TRP	CE2-CD2-CG	-6.68	101.96	107.30
1	A	172	VAL	CG1-CB-CG2	-6.67	100.22	110.90
1	A	173	ARG	NE-CZ-NH1	6.62	123.61	120.30
1	A	196	CYS	CA-C-N	6.57	131.66	117.20
1	A	99	ARG	NE-CZ-NH2	-6.57	117.02	120.30
1	A	161	TRP	CE2-CD2-CG	-6.56	102.05	107.30
1	B	186	TRP	CD1-CG-CD2	6.48	111.48	106.30
1	A	181	TRP	CB-CG-CD1	-6.47	118.59	127.00
1	A	125	TRP	CD1-CG-CD2	6.39	111.42	106.30
1	A	123	TRP	CD1-CG-CD2	6.36	111.39	106.30
1	A	78	TRP	CG-CD2-CE3	6.32	139.59	133.90
1	A	116	VAL	CG1-CB-CG2	-6.28	100.86	110.90
1	A	161	TRP	CD1-CG-CD2	6.28	111.32	106.30
1	A	144	ASP	CB-CG-OD2	6.27	123.95	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	161	TRP	CG-CD1-NE1	-6.19	103.91	110.10
1	A	125	TRP	CE2-CD2-CG	-6.18	102.36	107.30
1	B	123	TRP	CD1-CG-CD2	6.16	111.23	106.30
1	A	134	HIS	CA-CB-CG	6.09	123.96	113.60
1	A	186	TRP	CG-CD1-NE1	-6.09	104.01	110.10
1	B	161	TRP	CE2-CD2-CG	-6.08	102.44	107.30
1	B	54	VAL	CG1-CB-CG2	-6.07	101.19	110.90
1	A	181	TRP	CD1-CG-CD2	6.05	111.14	106.30
1	A	78	TRP	CG-CD1-NE1	-6.04	104.06	110.10
1	B	125	TRP	CG-CD1-NE1	-6.01	104.09	110.10
1	B	125	TRP	CE2-CD2-CG	-5.98	102.51	107.30
1	A	109	GLU	CA-CB-CG	5.97	126.54	113.40
1	B	181	TRP	CB-CG-CD1	-5.96	119.25	127.00
1	A	34	TYR	CB-CG-CD2	-5.82	117.51	121.00
1	B	194	MET	CA-CB-CG	5.75	123.07	113.30
1	B	181	TRP	CG-CD2-CE3	5.72	139.05	133.90
1	B	132	ARG	NE-CZ-NH1	5.63	123.12	120.30
1	A	123	TRP	CE2-CD2-CG	-5.55	102.86	107.30
1	A	11	TYR	CA-C-N	5.47	127.13	116.20
1	A	11	TYR	O-C-N	-5.47	113.91	123.20
1	B	123	TRP	CE2-CD2-CG	-5.43	102.96	107.30
1	B	81	LEU	CB-CG-CD2	-5.39	101.84	111.00
1	A	10	ASP	CA-CB-CG	5.39	125.25	113.40
1	A	183	VAL	CG1-CB-CG2	-5.34	102.35	110.90
1	A	125	TRP	CG-CD2-CE3	5.33	138.70	133.90
1	B	146	LEU	CB-CG-CD1	-5.33	101.94	111.00
1	A	108	LYS	CA-CB-CG	5.26	124.97	113.40
1	A	197	LYS	CA-C-N	-5.20	105.75	117.20
1	A	197	LYS	O-C-N	5.17	130.98	122.70
1	A	125	TRP	CB-CG-CD1	-5.07	120.41	127.00
1	B	78	TRP	CG-CD1-NE1	-5.04	105.06	110.10
1	A	147	GLN	CG-CD-NE2	5.02	128.76	116.70

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	166	TYR	Sidechain
1	B	195	ALA	Peptide
1	B	196	CYS	Peptide

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	1573	0	1526	29	0
1	B	1573	0	1527	17	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	95	0	0	1	0
3	B	74	0	0	1	0
All	All	3317	0	3053	45	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 7.

All (45) 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:196:CYS:O	1:A:197:LYS:N	1.60	1.28
1:A:196:CYS:C	1:A:197:LYS:CA	2.10	1.20
1:A:196:CYS:CA	1:A:197:LYS:N	2.15	1.09
1:B:31:HIS:HE1	1:B:71:HIS:HD2	1.20	0.86
1:A:196:CYS:C	1:A:197:LYS:N	0.80	0.84
1:A:31:HIS:HD2	1:A:78:TRP:HE1	1.39	0.70
1:A:93:LEU:HD11	1:A:189:VAL:HG23	1.75	0.69
1:B:31:HIS:HE1	1:B:71:HIS:CD2	2.06	0.69
1:B:31:HIS:CE1	1:B:71:HIS:HD2	2.08	0.68
1:A:153:ILE:HD13	1:A:196:CYS:SG	2.34	0.67
1:A:18:ILE:HA	1:A:168:GLN:HE22	1.59	0.66
1:A:146:LEU:O	1:A:150:THR:HB	1.97	0.65
1:B:96:ALA:HA	1:B:99:ARG:HE	1.63	0.63
1:A:144:ASP:HB3	1:A:149:THR:HG21	1.80	0.62
1:A:196:CYS:O	1:A:197:LYS:CA	2.27	0.62
1:B:35:VAL:HG22	1:B:71:HIS:CD2	2.39	0.56
1:B:106:LYS:HB3	1:B:110:LYS:HE2	1.88	0.56
1:B:31:HIS:HD2	1:B:78:TRP:HE1	1.53	0.55
1:B:5:PRO:O	1:B:27:HIS:HE1	1.92	0.52
1:B:158:ILE:HG13	1:B:158:ILE:O	2.10	0.51
1:A:107:PHE:CE1	1:A:126:LEU:HD13	2.47	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:96:ALA:HA	1:B:99:ARG:NE	2.28	0.49
1:A:31:HIS:CD2	1:A:78:TRP:HE1	2.26	0.49
1:A:187:GLU:O	1:A:191:GLU:HG3	2.13	0.49
1:A:196:CYS:O	1:A:197:LYS:HA	2.13	0.48
1:B:92:GLU:HG3	1:B:193:TYR:HE2	1.78	0.48
1:B:82:SER:HB2	1:B:185:ASN:HB2	1.96	0.47
1:B:11:TYR:CD2	1:B:24:GLN:HG2	2.49	0.47
1:B:97:ILE:HG23	1:B:101:PHE:HD1	1.80	0.46
1:A:116:VAL:HG23	1:A:177:LEU:HD13	1.99	0.45
1:A:147:GLN:NE2	3:A:301:HOH:O	2.44	0.45
1:A:31:HIS:HE1	1:A:71:HIS:ND1	2.15	0.44
1:A:35:VAL:HG12	1:A:71:HIS:ND1	2.33	0.44
1:B:170:LYS:HB2	1:B:170:LYS:HE2	1.81	0.44
1:A:121:SER:HB3	1:A:161:TRP:CD2	2.54	0.43
1:A:11:TYR:OH	1:A:27:HIS:HD2	2.02	0.43
1:A:11:TYR:CE1	1:A:24:GLN:HA	2.54	0.42
1:A:144:ASP:HA	1:A:145:PRO:HD3	1.91	0.42
1:A:107:PHE:HE1	1:A:126:LEU:HD13	1.84	0.42
1:A:18:ILE:HG21	1:A:23:MET:HE2	2.03	0.41
1:A:161:TRP:CH2	1:B:120:GLY:HA2	2.56	0.41
1:B:8:PRO:HD3	3:B:223:HOH:O	2.21	0.40
1:A:150:THR:HG22	1:A:152:LEU:HG	2.03	0.40
1:A:186:TRP:CE3	1:A:189:VAL:HG21	2.56	0.40
1:A:162:GLU:O	1:A:166:TYR:HB2	2.22	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	196/199 (98%)	190 (97%)	6 (3%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	196/199 (98%)	187 (95%)	9 (5%)	0	100	100
All	All	392/398 (98%)	377 (96%)	15 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	162/163 (99%)	148 (91%)	14 (9%)	10	10
1	B	162/163 (99%)	153 (94%)	9 (6%)	21	25
All	All	324/326 (99%)	301 (93%)	23 (7%)	14	16

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	6	ASP
1	A	10	ASP
1	A	31	HIS
1	A	60	LEU
1	A	64	LEU
1	A	84	ASN
1	A	93	LEU
1	A	118	VAL
1	A	134	HIS
1	A	177	LEU
1	A	180	ILE
1	A	183	VAL
1	A	187	GLU
1	A	198	LYS
1	B	1	LYS
1	B	31	HIS
1	B	81	LEU
1	B	82	SER

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Mol	Chain	Res	Type
1	B	95	GLU
1	B	98	LYS
1	B	136	GLN
1	B	146	LEU
1	B	158	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	2	HIS
1	A	27	HIS
1	A	31	HIS
1	A	37	ASN
1	A	67	ASN
1	A	147	GLN
1	A	168	GLN
1	B	24	GLN
1	B	27	HIS
1	B	31	HIS
1	B	71	HIS
1	B	142	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

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

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	2
1	B	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	195:ALA	C	196:CYS	N	1.17
1	A	195:ALA	C	196:CYS	N	1.11
1	A	196:CYS	C	197:LYS	N	0.80

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.