Full wwPDB X-ray Structure Validation Report (i)

Oct 28, 2024 – 06:42 pm GMT

PDB ID	:	7OJE
Title	:	Crystal structure of the covalent complex between Tribolium castaneum deubiquitinase ZUP and Ubiquitin-PA
Authors	:	Pichlo, C.; Hermanns, T.; Hofmann, K.; Baumann, U.
Deposited on	:	2021-05-14
Resolution	:	2.05 Å(reported)

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

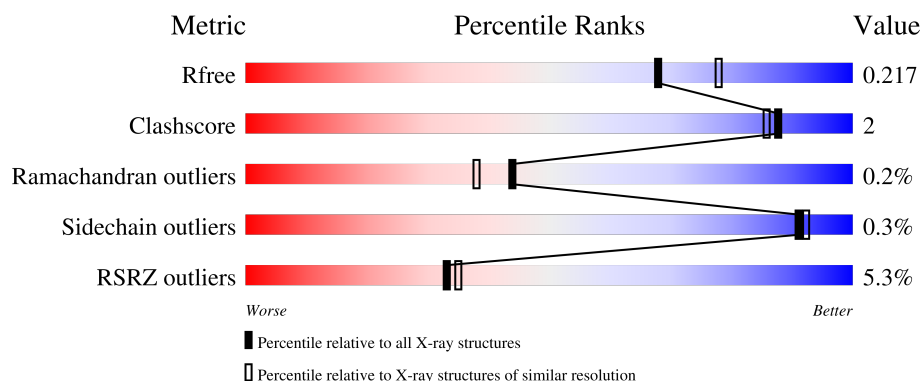|		
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

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 2.05 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	Percentile Ranks	Value
Rfree		0.217
Clashscore		2
Ramachandran outliers		0.2%
Sidechain outliers		0.3%
RSRZ outliers		5.3%

Worse　　　　　　　　　　　　　　　　　　*Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	2096 (2.04-2.04)
Clashscore	180529	2229 (2.04-2.04)
Ramachandran outliers	177936	2217 (2.04-2.04)
Sidechain outliers	177891	2217 (2.04-2.04)
RSRZ outliers	164620	2096 (2.04-2.04)

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% 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	375	3%　93%　5% ·
1	C	375	9%　90%　6% ·
2	B	76	95%　5%
2	D	76	%　96% ·

2 Entry composition ⓘ

There are 7 unique types of molecules in this entry. The entry contains 7398 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 Lys-63-specific deubiquitinase ZUFSP.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	365	Total	C	N	O	S	0	5	0
			2917	1809	542	548	18			
1	C	361	Total	C	N	O	S	0	1	0
			2839	1764	523	534	18			

- Molecule 2 is a protein called Polyubiquitin-B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	76	Total	C	N	O	S	0	0	0
			601	379	105	116	1			
2	D	76	Total	C	N	O	S	0	0	0
			601	379	105	116	1			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	76	AYE	GLY	engineered mutation	UNP P0CG47
D	76	AYE	GLY	engineered mutation	UNP P0CG47

- Molecule 3 is CITRIC ACID (three-letter code: CIT) (formula: $C_6H_8O_7$).

CIT

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total 13	C 6	O 7	0	0
3	C	1	Total 13	C 6	O 7	0	0

- Molecule 4 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: $C_2H_6O_2$).

EDO

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total 4	C 2	O 2	0	0
4	A	1	Total 4	C 2	O 2	0	0

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W O R L D W I D E

PDB

PROTEIN DATA BANK

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total 4	C 2	O 2	0	0
4	D	1	Total 4	C 2	O 2	0	0

- Molecule 5 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total 1	Zn 1	0	0
5	C	1	Total 1	Zn 1	0	0

- Molecule 6 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	2	Total 2	Na 2	0	0
6	C	1	Total 1	Na 1	0	0

- Molecule 7 is water.

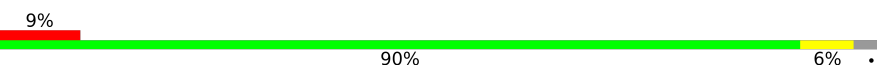| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	294	Total 294	O 294	0	0
7	B	56	Total 56	O 56	0	0
7	C	42	Total 42	O 42	0	0
7	D	1	Total 1	O 1	0	0

3 Residue-property plots ⓘ

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 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.
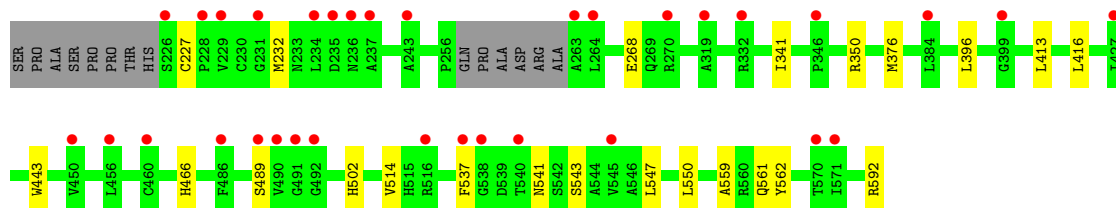
• Molecule 1: Lys-63-specific deubiquitinase ZUFSP

Chain A:

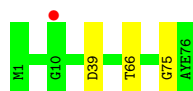• Molecule 1: Lys-63-specific deubiquitinase ZUFSP

Chain C:

• Molecule 2: Polyubiquitin-B

Chain B:

• Molecule 2: Polyubiquitin-B

Chain D:

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 61	Depositor
Cell constants a, b, c, α, β, γ	151.61Å 151.61Å 83.75Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	51.67 – 2.05 51.67 – 2.05	Depositor EDS
% Data completeness (in resolution range)	97.9 (51.67-2.05) 88.8 (51.67-2.05)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	0.76 (at 2.05Å)	Xtriage
Refinement program	PHENIX 1.19.1_4122, PHENIX 1.19.1_4122	Depositor
R, R_{free}	0.185 , 0.219 0.184 , 0.217	Depositor DCC
R_{free} test set	66814 reflections (2.87%)	wwPDB-VP
Wilson B-factor (Å^2)	29.0	Xtriage
Anisotropy	0.228	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 47.7	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.029 for h,-h-k,-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	7398	wwPDB-VP
Average B, all atoms (Å^2)	61.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.58% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: AYE, EDO, NA, ZN, CIT

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	0.42	0/2976	0.62	0/4025
1	C	0.28	0/2896	0.54	0/3919
2	B	0.37	0/603	0.60	0/811
2	D	0.26	0/603	0.54	0/811
All	All	0.35	0/7078	0.58	0/9566

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	2917	0	2858	12	0
1	C	2839	0	2771	13	0
2	B	601	0	630	4	0
2	D	601	0	630	3	0
3	A	13	0	4	0	0
3	C	13	0	4	0	0
4	A	8	0	12	2	0
4	B	4	0	6	0	0
4	D	4	0	6	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	1	0	0	0	0
5	C	1	0	0	0	0
6	A	2	0	0	0	0
6	C	1	0	0	0	0
7	A	294	0	0	1	1
7	B	56	0	0	1	0
7	C	42	0	0	0	0
7	D	1	0	0	0	0
All	All	7398	0	6921	26	1

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 (26) 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:C:341:ILE:HG22	1:C:547:LEU:HD22	1.72	0.70
1:C:227:CYS:HB3	1:C:232:MET:H	1.72	0.54
1:C:376:MET:HE3	1:C:413:LEU:HD13	1.89	0.54
1:C:341:ILE:HG12	1:C:543:SER:HB3	1.90	0.54
1:A:421:TRP:CG	1:A:430:SER:HB3	2.44	0.52
1:A:268:GLU:HG3	2:B:66:THR:HB	1.91	0.52
1:A:397:TRP:O	1:A:400:GLN:HG2	2.12	0.48
1:C:592:ARG:HH22	2:D:39:ASP:CG	2.17	0.48
1:C:396:LEU:HD13	1:C:416:LEU:HD11	1.94	0.48
1:C:537:PHE:HZ	1:C:550:LEU:HG	1.79	0.47
1:C:268:GLU:HG3	2:D:66:THR:HB	1.96	0.47
1:A:477:GLU:HG2	7:A:961:HOH:O	2.14	0.46
1:C:466:HIS:HA	1:C:561:GLN:HG3	1.98	0.46
1:A:341:ILE:HG12	1:A:543:SER:HB2	1.98	0.45
1:C:443:TRP:CE3	2:D:75:GLY:HA2	2.51	0.45
1:C:559:ALA:HB3	1:C:562:TYR:CZ	2.52	0.44
1:A:376:MET:HE3	1:A:413:LEU:HD13	1.99	0.44
1:A:559:ALA:HB2	4:A:602:EDO:H11	1.99	0.43
1:A:371:CYS:HB3	2:B:76:AYE:H3A	1.81	0.42
1:A:363:SER:HA	4:A:603:EDO:H12	2.01	0.42
1:A:373:TYR:HA	1:A:376:MET:HE2	2.01	0.42
1:A:443:TRP:CE3	2:B:75:GLY:HA2	2.54	0.42
1:C:350:ARG:HB2	1:C:514:VAL:HB	2.00	0.42
1:C:502:HIS:HB3	1:C:562:TYR:CD1	2.55	0.42
2:B:63:LYS:NZ	7:B:204:HOH:O	2.53	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:373:TYR:HA	1:A:376:MET:CE	2.51	0.41

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
7:A:835:HOH:O	7:A:874:HOH:O[3_454]	2.02	0.18

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	366/375 (98%)	357 (98%)	8 (2%)	1 (0%)	37	30
1	C	358/375 (96%)	346 (97%)	10 (3%)	2 (1%)	22	13
2	B	73/76 (96%)	72 (99%)	1 (1%)	0	100	100
2	D	73/76 (96%)	72 (99%)	1 (1%)	0	100	100
All	All	870/902 (96%)	847 (97%)	20 (2%)	3 (0%)	44	30

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	542	SER
1	C	489[A]	SER
1	C	489[B]	SER

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	319/322 (99%)	318 (100%)	1 (0%)	91	92
1	C	307/322 (95%)	306 (100%)	1 (0%)	91	92
2	B	68/68 (100%)	68 (100%)	0	100	100
2	D	68/68 (100%)	68 (100%)	0	100	100
All	All	762/780 (98%)	760 (100%)	2 (0%)	91	92

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	541	ASN
1	C	541	ASN

Sometimes 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 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 oligosaccharides in this entry.

5.6   Ligand geometry ⓘ

Of 11 ligands modelled in this entry, 5 are monoatomic - leaving 6 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	#$|Z| > 2$
3	CIT	A	601	6	12,12,12	0.98	0	17,17,17	2.13	3 (17%)
4	EDO	B	101	-	3,3,3	0.47	0	2,2,2	0.48	0
4	EDO	A	603	-	3,3,3	0.44	0	2,2,2	0.35	0
4	EDO	D	101	-	3,3,3	0.45	0	2,2,2	0.52	0
4	EDO	A	602	-	3,3,3	0.46	0	2,2,2	0.50	0
3	CIT	C	601	6	12,12,12	1.11	0	17,17,17	1.32	1 (5%)

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
3	CIT	A	601	6	-	4/16/16/16	-
4	EDO	B	101	-	-	0/1/1/1	-
4	EDO	A	603	-	-	1/1/1/1	-
4	EDO	D	101	-	-	1/1/1/1	-
4	EDO	A	602	-	-	1/1/1/1	-
3	CIT	C	601	6	-	0/16/16/16	-

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	601	CIT	O6-C6-C3	5.76	123.06	113.05
3	A	601	CIT	O5-C6-C3	-4.36	116.08	122.25
3	C	601	CIT	O6-C6-C3	3.68	119.45	113.05
3	A	601	CIT	O2-C1-C2	2.67	122.92	114.35

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	601	CIT	O1-C1-C2-C3
3	A	601	CIT	O2-C1-C2-C3
4	A	603	EDO	O1-C1-C2-O2
4	D	101	EDO	O1-C1-C2-O2
3	A	601	CIT	C3-C4-C5-O4

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Mol	Chain	Res	Type	Atoms
3	A	601	CIT	C3-C4-C5-O3
4	A	602	EDO	O1-C1-C2-O2

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	603	EDO	1	0
4	A	602	EDO	1	0

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, 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	365/375 (97%)	-0.32	12 (3%)	49	51	14, 35, 75, 121	5 (1%)
1	C	361/375 (96%)	0.87	33 (9%)	16	18	38, 80, 128, 154	1 (0%)
2	B	75/76 (98%)	-0.62	0	100	100	26, 36, 48, 52	0
2	D	75/76 (98%)	0.69	1 (1%)	74	77	64, 93, 112, 116	0
All	All	876/902 (97%)	0.23	46 (5%)	33	35	14, 60, 116, 154	6 (0%)

All (46) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	263	ALA	5.5
1	C	234	LEU	4.4
1	C	490	VAL	3.9
1	A	543	SER	3.6
1	C	226	SER	3.6
1	A	263	ALA	3.6
1	A	223	PRO	3.6
1	C	264	LEU	3.5
1	A	490	VAL	3.5
1	A	546	ALA	3.2
1	A	224	THR	3.2
1	C	537	PHE	3.0
1	C	571	ILE	2.9
1	C	384	LEU	2.9
1	C	228	PRO	2.8
1	C	491	GLY	2.7
1	C	489[A]	SER	2.7
1	C	399	GLY	2.7
1	C	450	VAL	2.6
1	C	540	THR	2.6
1	C	570	THR	2.6

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Mol	Chain	Res	Type	RSRZ
1	C	545	VAL	2.5
1	C	270	ARG	2.5
2	D	10	GLY	2.5
1	C	492	GLY	2.4
1	C	427	ILE	2.4
1	C	235	ASP	2.4
1	A	542	SER	2.4
1	A	257	GLN	2.3
1	A	264	LEU	2.3
1	A	544	ALA	2.3
1	A	225	HIS	2.3
1	C	460	CYS	2.3
1	C	237	ALA	2.2
1	C	538	GLY	2.2
1	C	486	PHE	2.2
1	C	243	ALA	2.2
1	C	319	ALA	2.2
1	C	231	GLY	2.1
1	C	229	VAL	2.1
1	C	456	LEU	2.1
1	C	346	PRO	2.1
1	A	236	ASN	2.1
1	C	236	ASN	2.0
1	C	332	ARG	2.0
1	C	516	ARG	2.0

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 monosaccharides 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. 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	B-factors(Å²)	Q<0.9
3	CIT	C	601	13/13	0.89	0.09	61,64,75,80	0
4	EDO	D	101	4/4	0.90	0.16	70,71,72,78	0
4	EDO	B	101	4/4	0.92	0.10	35,36,37,39	0
4	EDO	A	602	4/4	0.95	0.08	30,37,42,53	0
3	CIT	A	601	13/13	0.96	0.05	32,36,45,46	0
5	ZN	C	602	1/1	0.96	0.07	101,101,101,101	0
6	NA	C	603	1/1	0.96	0.05	63,63,63,63	0
4	EDO	A	603	4/4	0.97	0.07	38,39,43,58	0
6	NA	A	606	1/1	0.98	0.04	34,34,34,34	0
5	ZN	A	604	1/1	0.99	0.04	54,54,54,54	0
6	NA	A	605	1/1	0.99	0.05	30,30,30,30	0

6.5 Other polymers (i)

There are no such residues in this entry.