

Full wwPDB X-ray Structure Validation Report (i)

Oct 26, 2024 – 12:11 PM EDT

PDB ID : 6NO2

Title : ADP bound to K114bD mutant ATP-grasp fold of Blastocystis hominis

succinyl-CoA synthetase

Authors : Huang, J.; Fraser, M.E.

Deposited on : 2019-01-15

Resolution : 2.16 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.orgA user guide is available at

https://www.wwpdb.org/validation/2017/XrayValidationReportHelp with specific help available everywhere you see the (i) 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 (1)) were used in the production of this report:

MolProbity : 4.02b-467

Mogul : 2022.3.0, CSD as543be (2022)

Xtriage (Phenix) : 1.20.1

EDS : 3.0

buster-report : 1.1.7 (2018)

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)

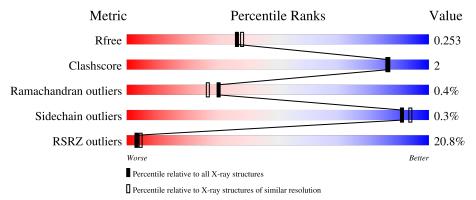
Validation Pipeline (wwPDB-VP) : 2.39

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure: X- $RAY\ DIFFRACTION$

The reported resolution of this entry is 2.16 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 $(\# \mathrm{Entries})$	$\begin{array}{c} {\rm Similar\ resolution} \\ (\#{\rm Entries},{\rm resolution\ range}(\mathring{\rm A})) \end{array}$
R_{free}	164625	1881 (2.16-2.16)
Clashscore	180529	2047 (2.16-2.16)
Ramachandran outliers	177936	2027 (2.16-2.16)
Sidechain outliers	177891	2026 (2.16-2.16)
RSRZ outliers	164620	1882 (2.16-2.16)

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	250	17% 89%		9%			
1	В	250	21%	5%	9%			



2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 7268 atoms, of which 3608 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—CoA ligase [ADP-forming] subunit beta.

Mol	Chain	Residues		Atoms			ZeroOcc	AltConf	Trace		
1	Λ	228	Total C	Н	N	О	S	0	0	0	0
1	Λ	220	3542	1113	1789	299	326	15			
1	D	228	Total	С	Н	N	О	S	0	0	0
1	Б	220	3542	1113	1789	299	326	15		0	U

There are 26 discrepancies between the modelled and reference sequences:

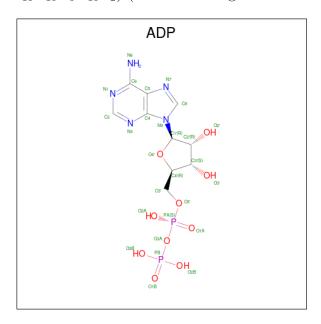
Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	initiating methionine	UNP B3FHP0
A	114	ASP	LYS	engineered mutation	UNP B3FHP0
A	240	GLY	-	expression tag	UNP B3FHP0
A	241	LEU	-	expression tag	UNP B3FHP0
A	242	GLU	-	expression tag	UNP B3FHP0
A	243	HIS	-	expression tag	UNP B3FHP0
A	244	HIS	-	expression tag	UNP B3FHP0
A	245	HIS	-	expression tag	UNP B3FHP0
A	246	HIS	-	expression tag	UNP B3FHP0
A	247	HIS	-	expression tag	UNP B3FHP0
A	248	HIS	-	expression tag	UNP B3FHP0
A	249	HIS	-	expression tag	UNP B3FHP0
A	250	HIS	-	expression tag	UNP B3FHP0
В	1	MET	-	initiating methionine	UNP B3FHP0
В	114	ASP	LYS	engineered mutation	UNP B3FHP0
В	240	GLY	-	expression tag	UNP B3FHP0
В	241	LEU	-	expression tag	UNP B3FHP0
В	242	GLU	-	expression tag	UNP B3FHP0
В	243	HIS	-	expression tag	UNP B3FHP0
В	244	HIS	-	expression tag	UNP B3FHP0
В	245	HIS	-	expression tag	UNP B3FHP0
В	246	HIS	-	expression tag	UNP B3FHP0
В	247	HIS	=	expression tag	UNP B3FHP0
В	248	HIS	-	expression tag	UNP B3FHP0
В	249	HIS	-	expression tag	UNP B3FHP0



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Chain	Residue	Modelled	Actual	Comment	Reference
В	250	HIS	-	expression tag	UNP B3FHP0

• Molecule 2 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf									
9	Λ	1	Total	С	Н	N	О	Р	0	0							
2	2 A	1	42	10	15	5	10	2	0								
9	D	D	D	D	D	D	D	D	1	Total	С	Н	N	О	Р	0	0
$\begin{bmatrix} 2 & B \end{bmatrix}$	1	42	10	15	5	10	2	U	U								

• Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

\mathbf{Mol}	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Mg 1 1	0	0
3	В	1	Total Mg 1 1	0	0

• Molecule 4 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total 1	Cl 1	0	0

• Molecule 5 is water.



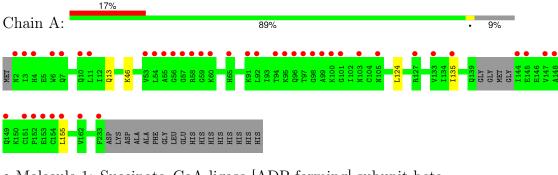
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	50	Total O 50 50	0	0
5	В	47	Total O 47 47	0	0



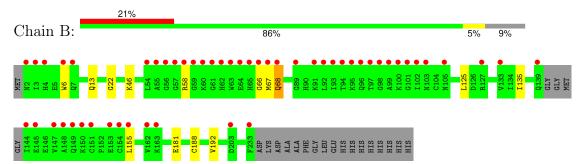
3 Residue-property plots (i)

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 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—CoA ligase [ADP-forming] subunit beta



• Molecule 1: Succinate-CoA ligase [ADP-forming] subunit beta





4 Data and refinement statistics (i)

Property	Value	Source	
Space group	C 1 2 1	Depositor	
Cell constants	114.02Å 77.75Å 77.11Å	Donogitor	
a, b, c, α , β , γ	90.00° 125.17° 90.00°	Depositor	
Resolution (Å)	54.54 - 2.16	Depositor	
rtesolution (A)	54.54 - 2.16	EDS	
% Data completeness	99.7 (54.54-2.16)	Depositor	
(in resolution range)	99.7 (54.54-2.16)	EDS	
R_{merge}	0.09	Depositor	
R_{sym}	(Not available)	Depositor	
$< I/\sigma(I) > 1$	1.66 (at 2.16Å)	Xtriage	
Refinement program	PHENIX 1.13_2998	Depositor	
P. P.	0.222 , 0.251	Depositor	
R, R_{free}	0.222 , 0.253	DCC	
R_{free} test set	1500 reflections (4.83%)	wwPDB-VP	
Wilson B-factor (Å ²)	34.5	Xtriage	
Anisotropy	0.304	Xtriage	
Bulk solvent $k_{sol}(e/Å^3)$, $B_{sol}(Å^2)$	0.41, 44.5	EDS	
L-test for twinning ²	$ < L >=0.49, < L^2>=0.32$	Xtriage	
Estimated twinning fraction	No twinning to report.	Xtriage	
F_o, F_c correlation	0.94	EDS	
Total number of atoms	7268	wwPDB-VP	
Average B, all atoms (Å ²)	58.0	wwPDB-VP	

Xtriage's analysis on translational NCS is as follows: The largest off-origin peak in the Patterson function is 14.00% of the height of the origin peak. No significant pseudotranslation is detected.

²Theoretical 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.



¹Intensities 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: CL, ADP, MG

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		
IVIOI	Chain	RMSZ	# Z > 5	RMSZ	# Z > 5	
1	A	0.25	0/1781	0.42	0/2399	
1	В	0.25	0/1781	0.42	0/2399	
All	All	0.25	0/3562	0.42	0/4798	

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 (i)

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	1753	1789	1789	5	0
1	В	1753	1789	1789	9	0
2	A	27	15	12	0	0
2	В	27	15	12	1	0
3	A	1	0	0	0	0
3	В	1	0	0	0	0
4	A	1	0	0	0	0
5	A	50	0	0	2	0
5	В	47	0	0	3	0
All	All	3660	3608	3602	14	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 (14) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic	Clash
Atom-1	Atom-2	${\rm distance}({\rm \AA})$	overlap (Å)
1:A:135:ILE:HG23	1:A:155:LEU:HD11	1.63	0.80
1:B:13:GLN:OE1	5:B:401:HOH:O	2.01	0.79
1:A:135:ILE:CG2	1:A:155:LEU:HD11	2.17	0.73
1:B:181:GLU:OE1	5:B:402:HOH:O	2.06	0.72
1:B:46:LYS:NZ	5:B:403:HOH:O	2.23	0.71
1:A:13:GLN:OE1	5:A:401:HOH:O	2.09	0.69
1:B:58:ARG:NH2	2:B:301:ADP:O1A	2.38	0.57
1:A:124:LEU:HD12	1:A:135:ILE:HD12	1.92	0.51
1:B:135:ILE:CG2	1:B:155:LEU:HD11	2.42	0.50
1:B:135:ILE:HG23	1:B:155:LEU:HD11	1.93	0.49
1:A:46:LYS:NZ	5:A:404:HOH:O	2.45	0.46
1:B:66:GLY:O	1:B:68:GLN:N	2.48	0.46
1:B:6:TRP:HZ3	1:B:22:GLY:O	2.02	0.42
1:B:188:CYS:O	1:B:192:VAL:HG23	2.20	0.42

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	$224/250 \ (90\%)$	221 (99%)	3 (1%)	0	100 100
1	В	$224/250 \ (90\%)$	218 (97%)	4 (2%)	2 (1%)	14 9
All	All	448/500 (90%)	439 (98%)	7 (2%)	2 (0%)	30 27

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	В	67	MET



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Mol	Chain	Res	Type
1	В	68	GLN

5.3.2 Protein sidechains (i)

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	Perc	entiles	3
1	A	192/208~(92%)	192 (100%)	0	100	100	
1	В	192/208 (92%)	191 (100%)	1 (0%)	86	91	
All	All	384/416 (92%)	383 (100%)	1 (0%)	91	94	

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	В	125	LEU

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

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 oligosaccharides in this entry.

5.6 Ligand geometry (i)

Of 5 ligands modelled in this entry, 3 are monoatomic - leaving 2 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	Trme	Chain	Dag	Link	Bo	ond leng	ths	В	ond ang	cles
MIOI	Type	Chain	Res	Lilik	Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	ADP	A	301	3	24,29,29	0.66	0	29,45,45	0.65	1 (3%)
2	ADP	В	301	3	24,29,29	0.65	0	29,45,45	0.74	2 (6%)

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
2	ADP	A	301	3	-	5/12/32/32	0/3/3/3
2	ADP	В	301	3	-	5/12/32/32	0/3/3/3

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	\mathbf{Z}	$Observed(^o)$	$Ideal(^{o})$
2	В	301	ADP	C5-C6-N6	2.28	123.78	120.31
2	A	301	ADP	C5-C6-N6	2.27	123.77	120.31
2	В	301	ADP	C4'-O4'-C1'	-2.12	107.98	109.92

There are no chirality outliers.

All (10) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	301	ADP	PA-O3A-PB-O3B
2	A	301	ADP	C5'-O5'-PA-O3A
2	В	301	ADP	PA-O3A-PB-O2B
2	В	301	ADP	PA-O3A-PB-O3B
2	В	301	ADP	C5'-O5'-PA-O3A
2	A	301	ADP	PB-O3A-PA-O2A
2	В	301	ADP	PB-O3A-PA-O2A
2	A	301	ADP	PA-O3A-PB-O1B



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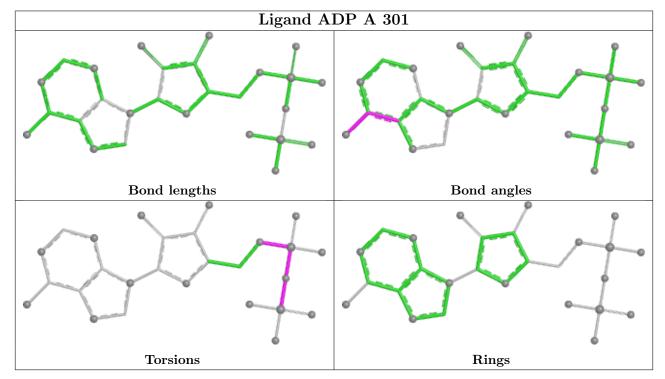
Mol	Chain	Res	Type	Atoms
2	A	301	ADP	PB-O3A-PA-O1A
2	В	301	ADP	PB-O3A-PA-O1A

There are no ring outliers.

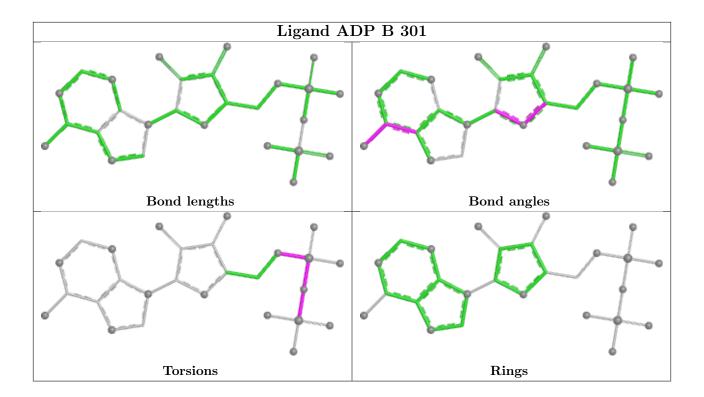
1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	В	301	ADP	1	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.







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 (i)

6.1 Protein, DNA and RNA chains (i)

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^{th} 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	$\langle { m RSRZ} \rangle$	$\# \mathrm{RSRZ}{>}2$	$OWAB(Å^2)$	Q < 0.9
1	A	228/250 (91%)	0.98	43 (18%) 4 5	26, 48, 117, 173	0
1	В	228/250 (91%)	1.27	52 (22%) 2 4	27, 49, 141, 186	0
All	All	456/500 (91%)	1.13	95 (20%) 3 4	26, 48, 129, 186	0

All (95) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	В	66	GLY	7.5
1	В	55	ALA	7.3
1	В	54	LEU	7.0
1	A	4	HIS	6.5
1	A	233	PHE	6.4
1	A	3	ILE	6.1
1	В	4	HIS	5.5
1	В	147	VAL	5.4
1	A	99	ALA	5.3
1	В	58	ARG	5.3
1	В	67	MET	5.2
1	A	54	LEU	5.2
1	В	3	ILE	5.1
1	В	93	ILE	4.9
1	В	233	PHE	4.9
1	В	99	ALA	4.8
1	В	148	ALA	4.8
1	A	147	VAL	4.8
1	В	144	ILE	4.7
1	A	148	ALA	4.7
1	A	2	ASN	4.5
1	В	92	LEU	4.5
1	В	162	VAL	4.4
1	A	144	ILE	4.2



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Mol	nued fron Chain	Res	Type	RSRZ
1	В	97	THR	4.1
1	В	105	ASN	4.0
1	A	162	VAL	4.0
1	В	100	LYS	4.0
1	В	2	ASN	4.0
1	A	95	LYS	3.9
1	В	94	THR	3.9
1	A	155	LEU	3.9
1	В	56	GLY	3.9
1	В	155	LEU	3.8
1	A	97	THR	3.7
1	В	101	GLY	3.6
1	A	152	PRO	3.6
1	В	149	GLN	3.6
1	В	61	GLY	3.5
1	В	98	GLY	3.5
1	A	135	ILE	3.3
1	A	57	GLY	3.3
1	В	65	HIS	3.3
1	В	153	GLU	3.3
1	A	98	GLY	3.2
1	A	101	GLY	3.2
1	В	127	ARG	3.2
1	В	89	GLY	3.1
1	A	105	ASN	3.1
1	A	151	CYS	3.1
1	A	55	ALA	3.1
1	A	127	ARG	3.1
1	В	68	GLN	3.0
1	A	94	THR	3.0
1	A	145	GLU	3.0
1	A	103	ASN	2.9
1	В	7	GLN	2.9
1	В	59	GLY	2.9
1	A	58	ARG	2.9
1	В	150	LYS	2.9
1	В	64	GLU	2.8
1	В	6	TRP	2.8
1	A	91	LYS	2.7
1	В	163	LYS	2.7
1	В	60	LYS	2.7
1	A	59	GLY	2.6



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Mol	Chain	Res	Type	RSRZ
1	В	57	GLY	2.6
1	В	102	ILE	2.6
1	В	151	CYS	2.6
1	В	133	VAL	2.6
1	A	100	LYS	2.6
1	A	7	GLN	2.6
1	A	149	GLN	2.6
1	В	91	LYS	2.5
1	A	154	CYS	2.4
1	В	63	TRP	2.4
1	A	60	LYS	2.4
1	В	96	GLN	2.4
1	В	154	CYS	2.4
1	A	56	GLY	2.4
1	A	65	HIS	2.3
1	A	92	LEU	2.3
1	В	95	LYS	2.2
1	A	133	VAL	2.2
1	В	62	HIS	2.2
1	A	96	GLN	2.2
1	A	153	GLU	2.2
1	A	10	GLN	2.1
1	A	11	LEU	2.1
1	В	203	ASP	2.1
1	В	103	ASN	2.0
1	В	145	GLU	2.0
1	A	53	VAL	2.0
1	В	139	GLN	2.0
1	A	6	TRP	2.0

6.2 Non-standard residues in protein, DNA, RNA chains (i)

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

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

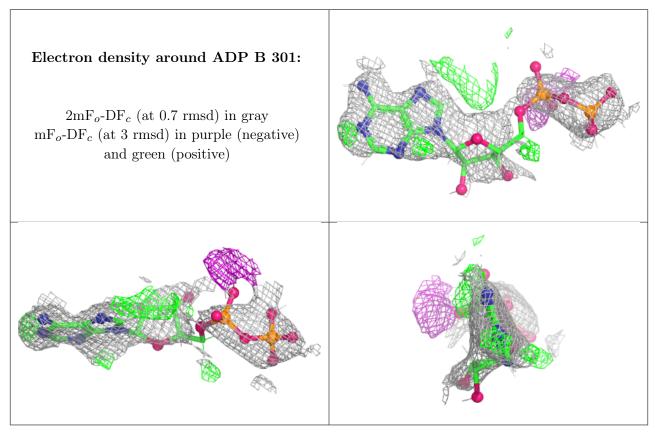


6.4 Ligands (i)

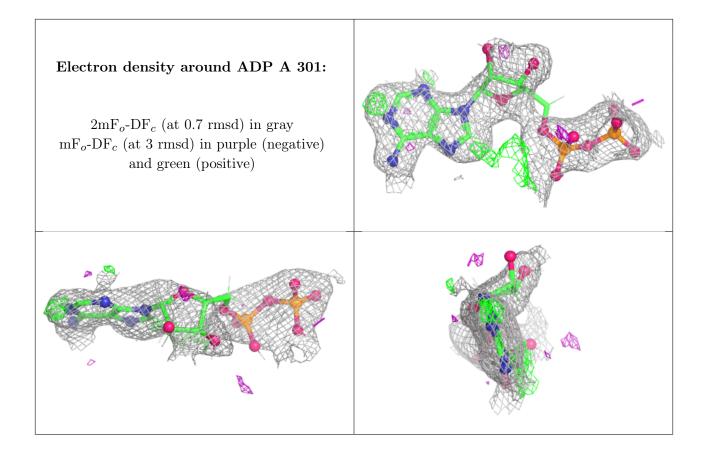
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	$\mathbf{B} ext{-}\mathbf{factors}(\mathbf{\mathring{A}}^2)$	Q<0.9
2	ADP	В	301	27/27	0.62	0.22	53,88,116,139	42
2	ADP	A	301	27/27	0.72	0.20	54,75,91,108	42
3	MG	В	302	1/1	0.73	0.18	62,62,62,62	0
3	MG	A	302	1/1	0.82	0.14	69,69,69,69	0
4	CL	A	303	1/1	0.99	0.04	29,29,29,29	1

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.







6.5 Other polymers (i)

There are no such residues in this entry.

