WORLDWIDE PDB PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 10, 2024 – 08:41 PM EST

PDB ID	:	2P9N
Title	:	Crystal Structure of bovine Arp2/3 complex co-crystallized with ADP
Authors	:	Nolen, B.J.; Pollard, T.D.
Deposited on	:	2007-03-26
Resolution	:	2.85 Å(reported)

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)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
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 ⓘ

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

The reported resolution of this entry is 2.85 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.
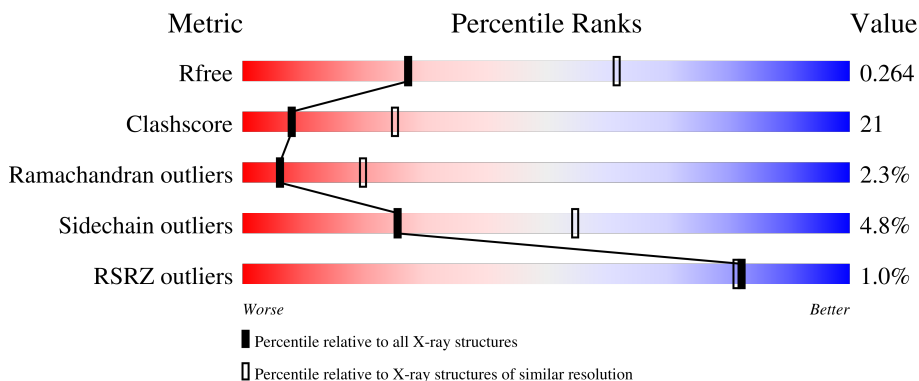
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	3168 (2.90-2.82)
Clashscore	141614	3438 (2.90-2.82)
Ramachandran outliers	138981	3348 (2.90-2.82)
Sidechain outliers	138945	3351 (2.90-2.82)
RSRZ outliers	127900	3103 (2.90-2.82)

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	418	
2	B	394	
3	C	372	
4	D	300	
5	E	178	

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
6	F	168	74% 23% ··
7	G	151	% 56% 30% ·· 11%

2 Entry composition ⓘ

There are 9 unique types of molecules in this entry. The entry contains 13541 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 Actin-like protein 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	397	Total	C	N	O	S	0	0	0
			3177	2042	528	592	15			

- Molecule 2 is a protein called Actin-like protein 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	203	Total	C	N	O	S	0	0	0
			1572	1006	268	294	4			

- Molecule 3 is a protein called Actin-related protein 2/3 complex subunit 1B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	341	Total	C	N	O	S	0	0	0
			2648	1680	464	485	19			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	58	VAL	ILE	conflict	UNP Q58CQ2

- Molecule 4 is a protein called Actin-related protein 2/3 complex subunit 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	283	Total	C	N	O	S	0	0	0
			2287	1453	396	430	8			

- Molecule 5 is a protein called Actin-related protein 2/3 complex subunit 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	173	Total	C	N	O	S	0	0	0
			1408	904	235	260	9			

- Molecule 6 is a protein called Actin-related protein 2/3 complex subunit 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
6	F	167	Total 1371	C 875	N 239	O 248	S 9	0	0	0

- Molecule 7 is a protein called Actin-related protein 2/3 complex subunit 5.

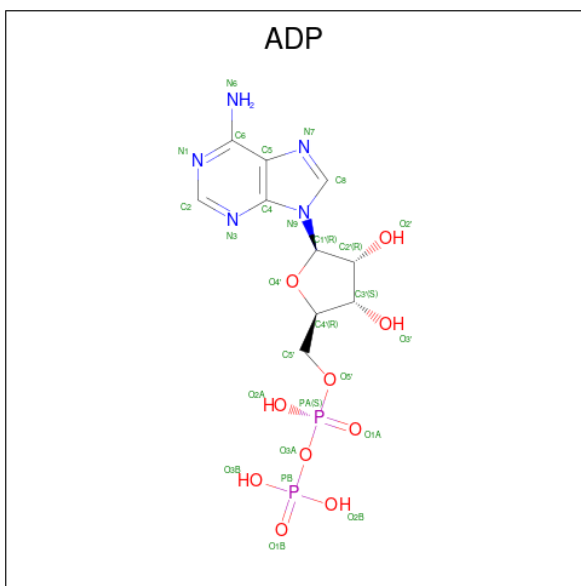| Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
7	G	134	Total 1023	C 642	N 179	O 199	S 3	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
G	17	ASP	GLY	conflict	UNP Q3SYX9
G	28	ASP	GLU	conflict	UNP Q3SYX9

- Molecule 8 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	1	Total 1	Ca 1	0	0

- Molecule 9 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$).

ADP

| Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
9	A	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
9	B	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

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: Actin-like protein 3
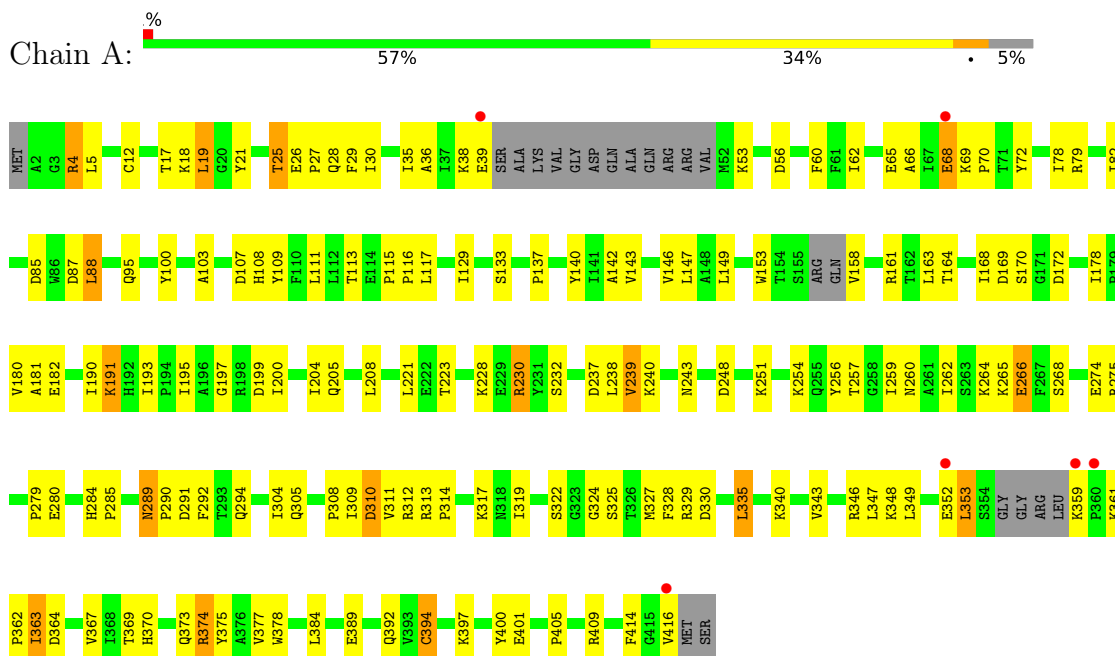
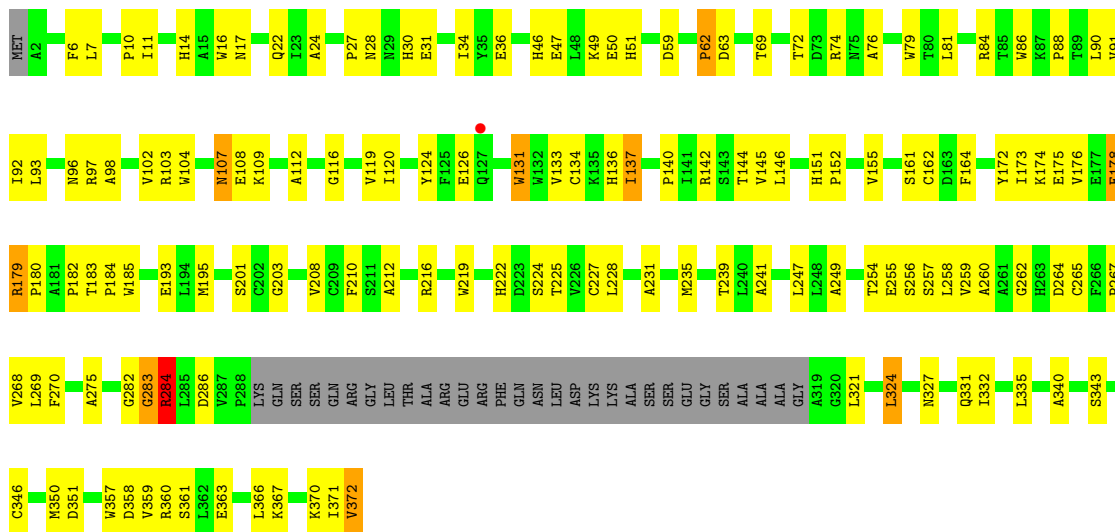- Molecule 2: Actin-like protein 2
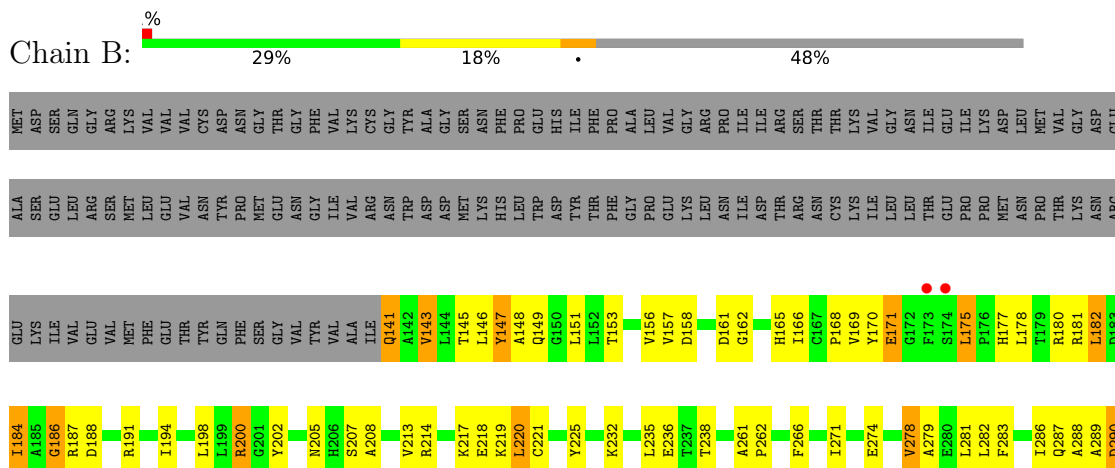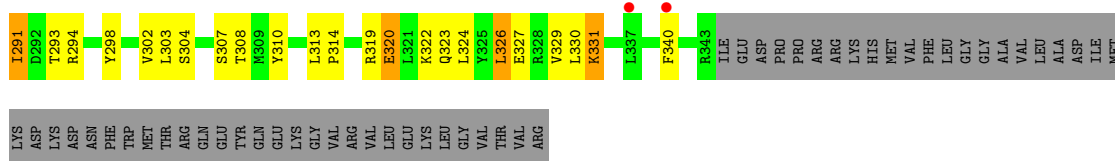
- Molecule 3: Actin-related protein 2/3 complex subunit 1B

Chain C:

- Molecule 4: Actin-related protein 2/3 complex subunit 2
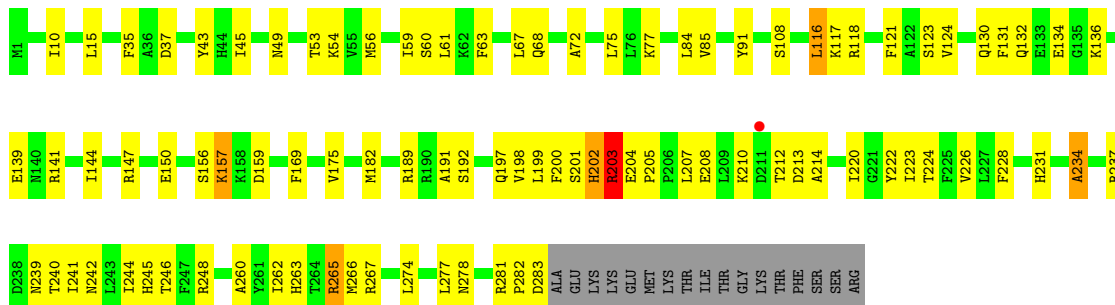
Chain D:

- Molecule 5: Actin-related protein 2/3 complex subunit 3
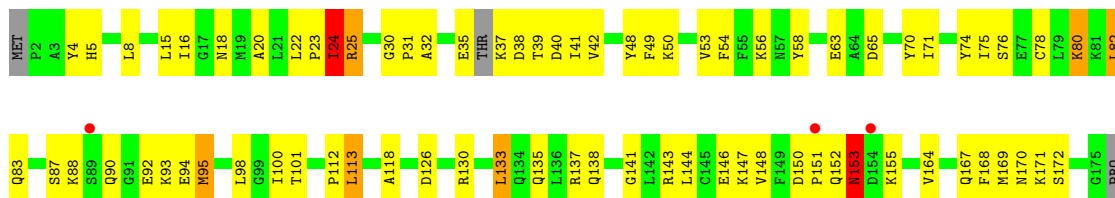
Chain E:

GLY
GLN

● Molecule 6: Actin-related protein 2/3 complex subunit 4

Chain F:

74% 23%

MET T2 A3 T4 L5 R6 P7 L20 C21 L22 F25 Q28 V29 V30 E31 R32 H33 P36 E39 V40 R41 E45 I53 S54 R55 N56 E57 K60 I67 R71 A75 D80 E83 M96 R97 A98 F101 F102 I103 L104 R105 R106 Y112

F121 Q125 V132 H137 E141 E145 A161 E162 E163 F164 L165 K166 N167 F168
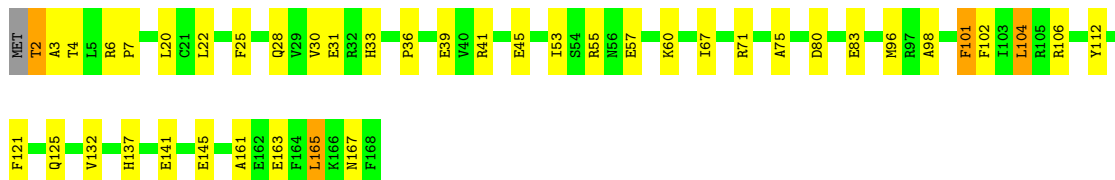
● Molecule 7: Actin-related protein 2/3 complex subunit 5

Chain G:

%

56% 30% 11%

MET SER LYS ASN THR VAL SER SER A9 R10 F11 V14 Y19 D20 E21 N22 K23 F24 V25 D26 GLU ASP ASP GLY GLY ASP GLY GLN A35 E39 D43 S44 C45 L46 R47 Q48 M51 T52 Q56 A57 A58 L59 K60 N61 I64 N65 T66 K67 S68 V71 R74

I78 V79 V82 L83 F86 K87 A88 N89 D90 D99 G102 I110 Y111 K112 G113 S116 P117 S118 D119 ASN S121 L125 W128 S140 V144 K149 T150 V151
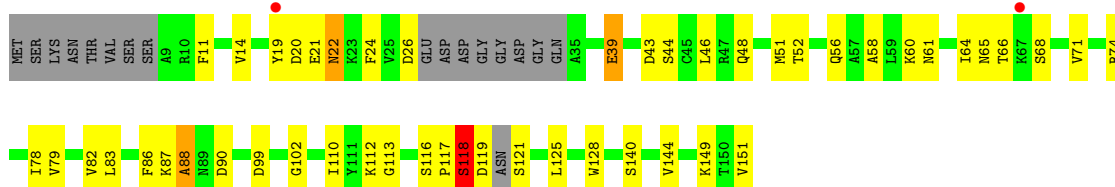
4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	111.13Å 129.27Å 203.86Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.85 46.83 – 2.84	Depositor EDS
% Data completeness (in resolution range)	93.1 (50.00-2.85) 92.6 (46.83-2.84)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.21 (at 2.86Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.232 , 0.272 0.221 , 0.264	Depositor DCC
R_{free} test set	3465 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å^2)	54.2	Xtriage
Anisotropy	0.076	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 34.0	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	0.91	EDS
Total number of atoms	13541	wwPDB-VP
Average B, all atoms (Å^2)	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.70% of the height of the origin peak. No significant pseudotranslation is detected.*

---

[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: CA, ADP

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	0.41	0/3257	0.63	0/4418
2	B	0.36	0/1600	0.64	0/2167
3	C	0.40	0/2717	0.68	3/3688 (0.1%)
4	D	0.41	0/2336	0.64	1/3154 (0.0%)
5	E	0.36	0/1441	0.60	0/1941
6	F	0.43	0/1393	0.68	1/1868 (0.1%)
7	G	0.48	1/1034 (0.1%)	0.67	2/1389 (0.1%)
All	All	0.40	1/13778 (0.0%)	0.65	7/18625 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	G	118	SER	C-O	-5.56	1.12	1.23

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
7	G	116	SER	C-N-CD	7.62	144.41	128.40
4	D	204	GLU	N-CA-C	-7.43	90.94	111.00
6	F	101	PHE	N-CA-C	-5.40	96.42	111.00
3	C	137	ILE	N-CA-C	-5.32	96.64	111.00
3	C	283	GLY	N-CA-C	5.30	126.36	113.10

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	3177	0	3123	146	0
2	B	1572	0	1559	91	0
3	C	2648	0	2602	134	0
4	D	2287	0	2252	72	0
5	E	1408	0	1408	74	0
6	F	1371	0	1410	37	0
7	G	1023	0	1041	45	0
8	A	1	0	0	0	0
9	A	27	0	12	2	0
9	B	27	0	12	8	0
All	All	13541	0	13419	575	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 21.

The worst 5 of 575 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)
3:C:256:SER:HB2	3:C:372:VAL:HG12	1.20	1.17
3:C:183:THR:HG22	3:C:185:TRP:H	1.08	1.09
2:B:166:ILE:HD12	2:B:281:LEU:HD22	1.34	1.08
5:E:88:LYS:H	5:E:153:ASN:ND2	1.52	1.07
4:D:197:GLN:HE21	4:D:199:LEU:HD11	1.23	0.99

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	389/418 (93%)	347 (89%)	36 (9%)	6 (2%)	10	30
2	B	201/394 (51%)	164 (82%)	24 (12%)	13 (6%)	1	3
3	C	337/372 (91%)	297 (88%)	34 (10%)	6 (2%)	8	25
4	D	281/300 (94%)	255 (91%)	24 (8%)	2 (1%)	22	50
5	E	169/178 (95%)	136 (80%)	25 (15%)	8 (5%)	2	7
6	F	165/168 (98%)	156 (94%)	8 (5%)	1 (1%)	25	53
7	G	128/151 (85%)	115 (90%)	10 (8%)	3 (2%)	6	20
All	All	1670/1981 (84%)	1470 (88%)	161 (10%)	39 (2%)	6	20

5 of 39 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	266	GLU
2	B	147	TYR
2	B	171	GLU
5	E	153	ASN
2	B	145	THR

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	347/363 (96%)	330 (95%)	17 (5%)	25	54
2	B	164/345 (48%)	155 (94%)	9 (6%)	21	49
3	C	290/313 (93%)	278 (96%)	12 (4%)	30	61
4	D	249/264 (94%)	239 (96%)	10 (4%)	31	62
5	E	155/159 (98%)	147 (95%)	8 (5%)	23	51
6	F	154/155 (99%)	148 (96%)	6 (4%)	32	63
7	G	110/124 (89%)	102 (93%)	8 (7%)	14	35
All	All	1469/1723 (85%)	1399 (95%)	70 (5%)	25	55

5 of 70 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
6	F	22	LEU
6	F	102	PHE
7	G	39	GLU
2	B	320	GLU
2	B	274	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 35 such sidechains are listed below:

Mol	Chain	Res	Type
6	F	17	GLN
6	F	28	GLN
7	G	61	ASN
2	B	284	ASN
2	B	205	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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 3 ligands modelled in this entry, 1 is 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	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#$|Z|$ > 2	Counts	RMSZ	#$|Z|$ > 2
9	ADP	B	395	-	24,29,29	1.37	3 (12%)	29,45,45	1.53	4 (13%)
9	ADP	A	501	-	24,29,29	1.37	3 (12%)	29,45,45	1.68	5 (17%)

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
9	ADP	B	395	-	-	1/12/32/32	0/3/3/3
9	ADP	A	501	-	-	6/12/32/32	0/3/3/3

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	A	501	ADP	C2-N1	3.70	1.40	1.33
9	B	395	ADP	C2-N1	3.67	1.40	1.33
9	A	501	ADP	PB-O1B	3.40	1.61	1.50
9	B	395	ADP	PB-O1B	3.39	1.61	1.50
9	B	395	ADP	O4'-C1'	2.21	1.44	1.41

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
9	B	395	ADP	N3-C2-N1	-5.44	120.17	128.68
9	A	501	ADP	N3-C2-N1	-5.38	120.27	128.68
9	A	501	ADP	O4'-C1'-C2'	-3.95	101.15	106.93
9	A	501	ADP	PA-O3A-PB	-3.37	121.28	132.83
9	B	395	ADP	PA-O3A-PB	-2.75	123.40	132.83

There are no chirality outliers.

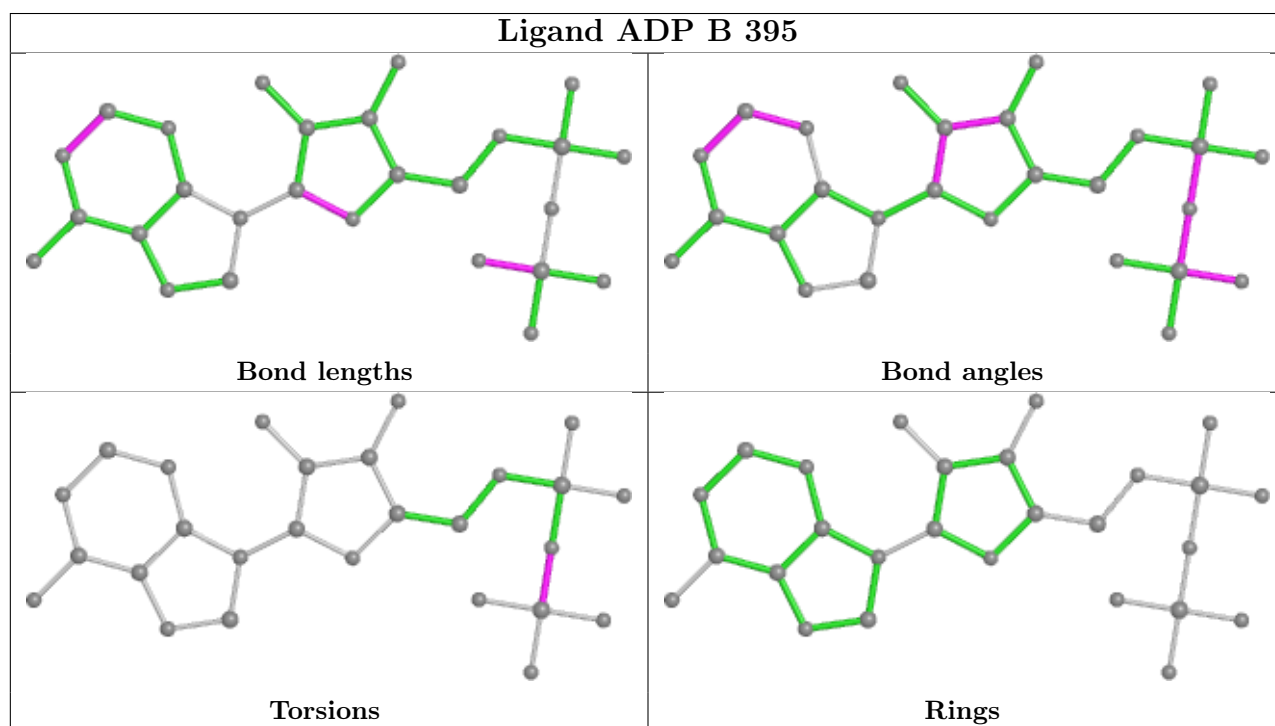5 of 7 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	A	501	ADP	C5'-O5'-PA-O2A
9	A	501	ADP	C5'-O5'-PA-O3A
9	A	501	ADP	PB-O3A-PA-O1A
9	A	501	ADP	C5'-O5'-PA-O1A
9	A	501	ADP	PB-O3A-PA-O2A

There are no ring outliers.

2 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
9	B	395	ADP	8	0
9	A	501	ADP	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 ADP B 395

Bond lengths

Bond angles

Torsions

Rings

Ligand ADP A 501

Bond lengths

Bond angles

Torsions

Rings
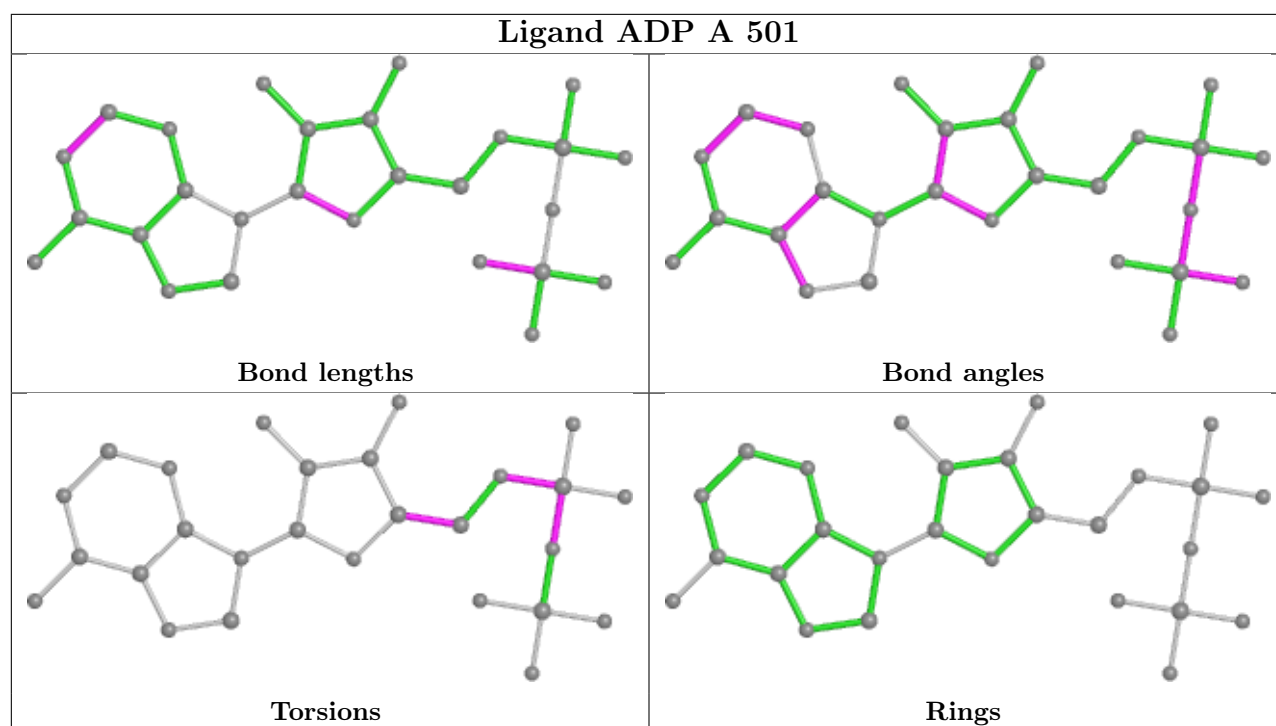
5.7 Other polymers ⓘ

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(Å²)	Q<0.9
1	A	397/418 (94%)	-0.25	6 (1%)	73	72	21, 48, 87, 109	0
2	B	203/394 (51%)	-0.07	4 (1%)	65	62	29, 62, 101, 113	0
3	C	341/372 (91%)	-0.31	1 (0%)	94	94	27, 44, 71, 92	0
4	D	283/300 (94%)	-0.35	1 (0%)	92	92	25, 42, 66, 92	0
5	E	173/178 (97%)	-0.12	3 (1%)	70	68	44, 60, 86, 99	0
6	F	167/168 (99%)	-0.50	0	100	100	25, 36, 48, 75	0
7	G	134/151 (88%)	0.06	2 (1%)	73	72	36, 67, 86, 94	0
All	All	1698/1981 (85%)	-0.25	17 (1%)	82	81	21, 47, 87, 113	0

The worst 5 of 17 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	D	211	ASP	5.0
2	B	174	SER	4.4
2	B	337	LEU	3.8
7	G	67	LYS	3.6
1	A	359	LYS	2.9

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

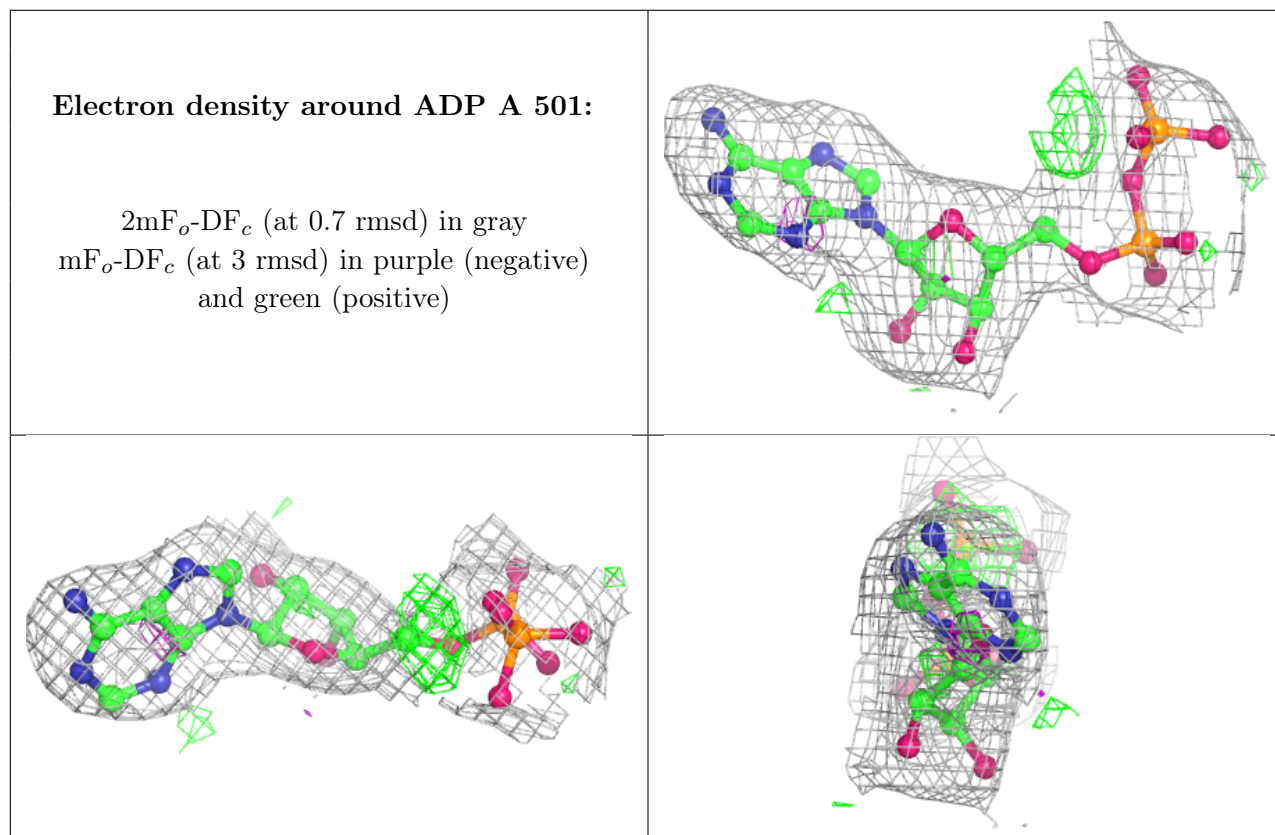There are no non-standard protein/DNA/RNA residues in this entry.

6.3   Carbohydrates ⓘ

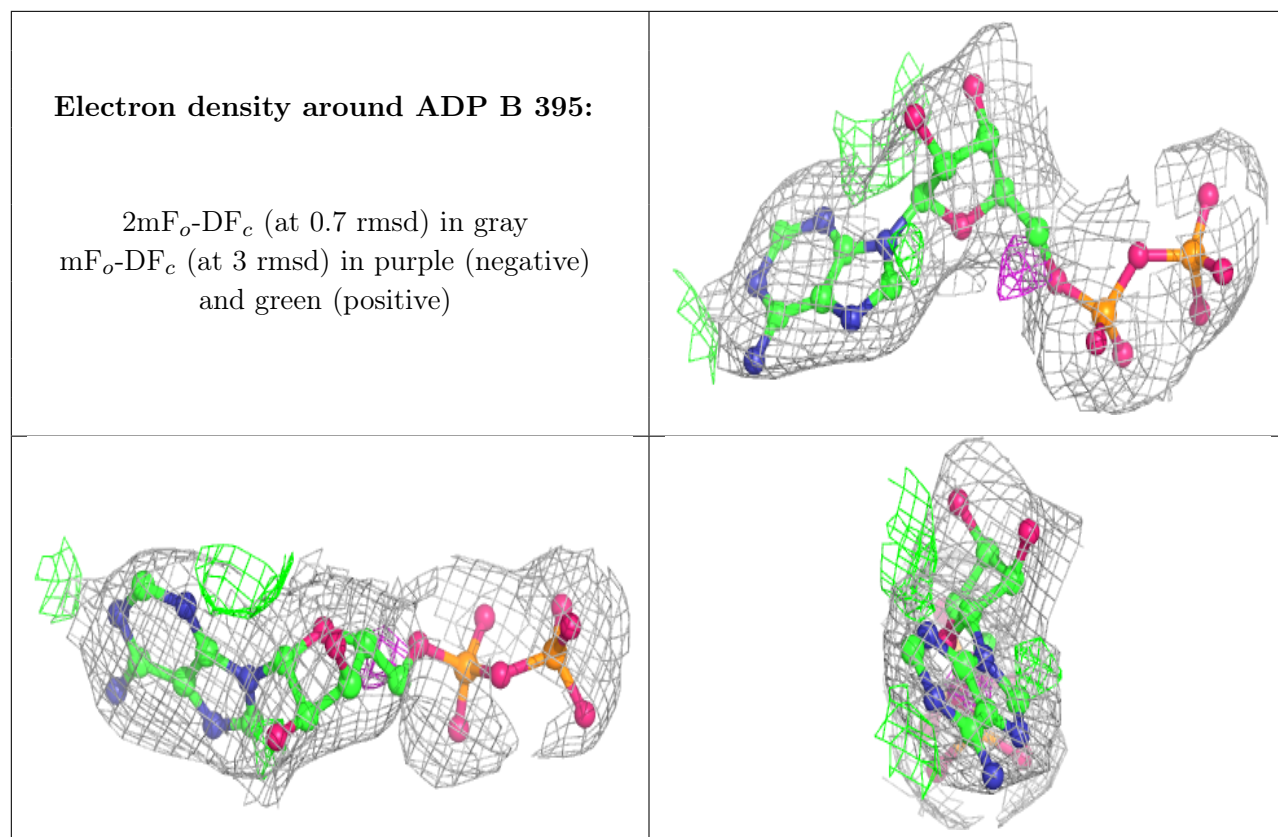There are no monosaccharides in this entry.

WORLDWIDE
wwPDB
PROTEIN DATA BANK

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(Å^2)	Q<0.9
9	ADP	A	501	27/27	0.87	0.17	55,64,95,96	0
9	ADP	B	395	27/27	0.93	0.15	54,60,74,76	0
8	CA	A	500	1/1	0.97	0.18	68,68,68,68	0

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.

Electron density around ADP A 501:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative) and green (positive)

Electron density around ADP B 395:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

6.5 Other polymers ⓘ

There are no such residues in this entry.