Full wwPDB X-ray Structure Validation Report (i)

Dec 13, 2023 – 08:25 am GMT

PDB ID	:	2X9A
Title	:	crystal structure of g3p from phage IF1 in complex with its coreceptor, the C-terminal domain of TolA
Authors	:	Lorenz, S.H.; Jakob, R.P.; Dobbek, H.; Schmid, F.X.
Deposited on	:	2010-03-15
Resolution	:	2.47 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 (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:

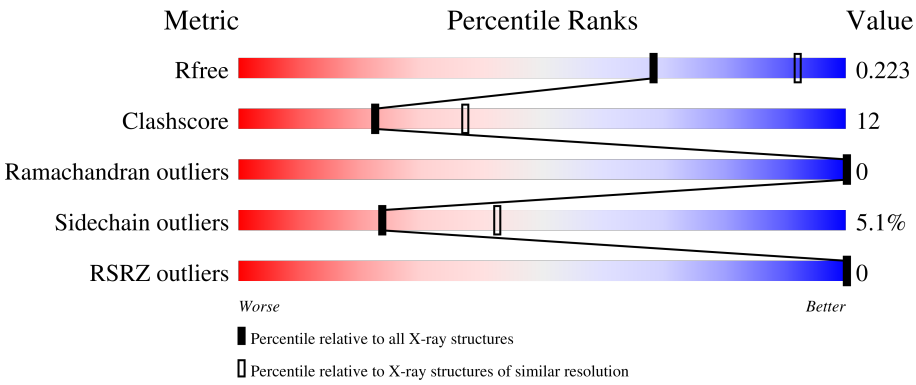
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.47 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	5857 (2.50-2.46)
Clashscore	141614	6594 (2.50-2.46)
Ramachandran outliers	138981	6469 (2.50-2.46)
Sidechain outliers	138945	6471 (2.50-2.46)
RSRZ outliers	127900	5738 (2.50-2.46)

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	65	66% 26% • 6%
1	C	65	66% 28% 6%
2	B	136	51% 15% • 34%
2	D	136	50% 14% • 34%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 2338 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 ATTACHMENT PROTEIN G3P.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	61	476	296	79	99	2	0	0	0
1	C	61	476	296	79	99	2	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	51	TRP	CYS	conflict	UNP O80297
C	51	TRP	CYS	conflict	UNP O80297

- Molecule 2 is a protein called MEMBRANE SPANNING PROTEIN, REQUIRED FOR OUTER MEMBRANE INTEGRITY.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	90	664	426	109	126	3	0	0	0
2	D	90	664	426	109	126	3	0	0	0

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	421	ALA	-	expression tag	UNP Q8X965
B	422	ALA	-	expression tag	UNP Q8X965
B	423	ALA	-	expression tag	UNP Q8X965
B	424	HIS	-	expression tag	UNP Q8X965
B	425	HIS	-	expression tag	UNP Q8X965
B	426	HIS	-	expression tag	UNP Q8X965
B	427	HIS	-	expression tag	UNP Q8X965
B	428	HIS	-	expression tag	UNP Q8X965
B	429	HIS	-	expression tag	UNP Q8X965

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Chain	Residue	Modelled	Actual	Comment	Reference
D	421	ALA	-	expression tag	UNP Q8X965
D	422	ALA	-	expression tag	UNP Q8X965
D	423	ALA	-	expression tag	UNP Q8X965
D	424	HIS	-	expression tag	UNP Q8X965
D	425	HIS	-	expression tag	UNP Q8X965
D	426	HIS	-	expression tag	UNP Q8X965
D	427	HIS	-	expression tag	UNP Q8X965
D	428	HIS	-	expression tag	UNP Q8X965
D	429	HIS	-	expression tag	UNP Q8X965

- Molecule 3 is water.

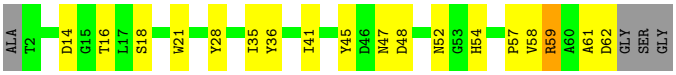
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	13	13	13	0	0
			Total	O		
3	B	15	15	15	0	0
			Total	O		
3	C	14	14	14	0	0
			Total	O		
3	D	16	16	16	0	0

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.

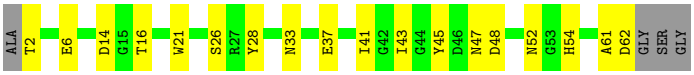
• Molecule 1: ATTACHMENT PROTEIN G3P

Chain A:



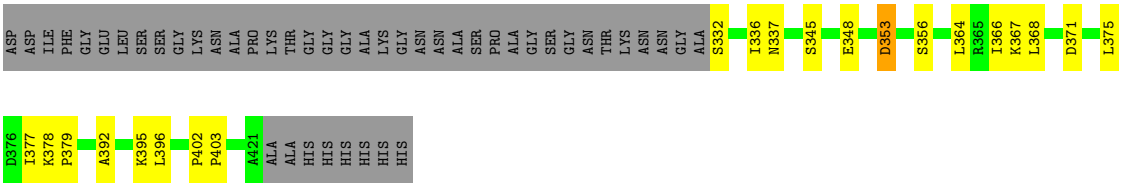
• Molecule 1: ATTACHMENT PROTEIN G3P

Chain C:



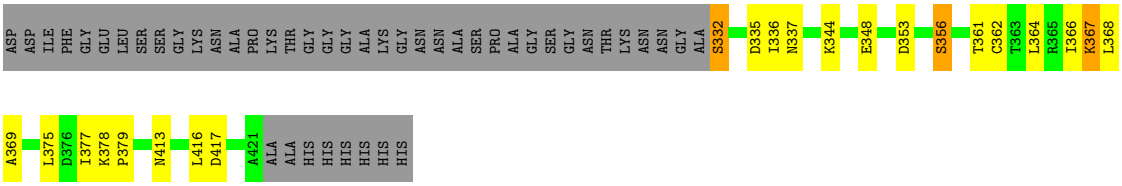
• Molecule 2: MEMBRANE SPANNING PROTEIN, REQUIRED FOR OUTER MEMBRANE INTEGRITY

Chain B:



• Molecule 2: MEMBRANE SPANNING PROTEIN, REQUIRED FOR OUTER MEMBRANE INTEGRITY

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, α, β, γ	94.52Å 94.52Å 132.11Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	32.22 – 2.47 32.22 – 2.47	Depositor EDS
% Data completeness (in resolution range)	97.5 (32.22-2.47) 97.5 (32.22-2.47)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.56 (at 2.48Å)	Xtriage
Refinement program	PHENIX (PHENIX.REFINE)	Depositor
R, R_{free}	0.181 , 0.229 0.177 , 0.223	Depositor DCC
R_{free} test set	771 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	56.0	Xtriage
Anisotropy	0.039	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 36.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.489 for h,-h-k,-l	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	2338	wwPDB-VP
Average B, all atoms (Å^2)	59.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.65% 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 (i)

5.1 Standard geometry (i)

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	0.39	0/489	0.53	0/667
1	C	0.38	0/489	0.53	0/667
2	B	0.40	0/678	0.57	0/918
2	D	0.37	0/678	0.53	0/918
All	All	0.38	0/2334	0.54	0/3170

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	476	0	420	14	0
1	C	476	0	420	15	0
2	B	664	0	676	10	0
2	D	664	0	676	21	0
3	A	13	0	0	2	0
3	B	15	0	0	1	0
3	C	14	0	0	0	0
3	D	16	0	0	0	0
All	All	2338	0	2192	52	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 12.

All (52) 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:43:ILE:HD11	2:D:344:LYS:HB2	1.42	0.98
2:D:367:LYS:HE2	2:D:413:ASN:HD22	1.37	0.87
2:D:364:LEU:HD23	2:D:377:ILE:HD11	1.56	0.85
2:B:364:LEU:HD23	2:B:377:ILE:HD11	1.60	0.83
2:D:366:ILE:O	2:D:367:LYS:HE3	1.79	0.81
2:D:366:ILE:HD12	2:D:368:LEU:HD13	1.70	0.73
2:D:367:LYS:HE2	2:D:413:ASN:ND2	2.04	0.72
1:C:14:ASP:OD1	1:C:54:HIS:HD2	1.77	0.67
1:A:14:ASP:OD1	1:A:54:HIS:HD2	1.82	0.62
2:D:369:ALA:HB2	2:D:375:LEU:CD1	2.29	0.61
2:B:366:ILE:HD12	2:B:368:LEU:HD13	1.82	0.61
2:D:353:ASP:O	2:D:356:SER:HB3	2.01	0.60
1:C:16:THR:HG21	1:C:45:TYR:OH	2.02	0.58
1:A:18:SER:HB2	3:A:2011:HOH:O	2.04	0.58
1:C:52:ASN:ND2	2:D:337:ASN:ND2	2.52	0.58
1:C:47:ASN:O	1:C:48:ASP:HB2	2.02	0.57
1:A:35:ILE:HD13	1:A:59:ARG:NH1	2.24	0.52
2:B:353:ASP:HB3	2:B:356:SER:OG	2.10	0.52
2:B:392:ALA:HA	2:B:395:LYS:HG2	1.92	0.52
1:A:36:TYR:CE1	1:A:57:PRO:HD3	2.47	0.50
2:D:332:SER:HB2	2:D:335:ASP:HB2	1.93	0.50
1:C:52:ASN:HD22	2:D:337:ASN:ND2	2.09	0.50
2:D:367:LYS:CE	2:D:413:ASN:HD22	2.16	0.50
1:C:61:ALA:O	1:C:62:ASP:HB2	2.11	0.49
1:A:61:ALA:O	1:A:62:ASP:HB2	2.13	0.49
1:C:2:THR:HA	1:C:6:GLU:OE1	2.13	0.49
1:A:41:ILE:HD12	2:B:348:GLU:HG3	1.94	0.48
1:C:43:ILE:HD11	2:D:344:LYS:CB	2.29	0.47
1:A:35:ILE:HD13	1:A:59:ARG:HH11	1.79	0.47
1:C:2:THR:HG21	1:C:33:ASN:HB3	1.97	0.46
2:D:332:SER:O	2:D:336:ILE:HG13	2.15	0.46
1:A:16:THR:HG21	1:A:45:TYR:OH	2.16	0.46
2:B:378:LYS:HA	2:B:379:PRO:HD3	1.82	0.45
1:A:47:ASN:O	1:A:48:ASP:HB2	2.16	0.45
2:D:364:LEU:HD23	2:D:377:ILE:CD1	2.39	0.45
2:D:369:ALA:HB2	2:D:375:LEU:HD11	1.98	0.45
2:B:402:PRO:HA	2:B:403:PRO:HD3	1.85	0.45
2:B:367:LYS:HD2	3:B:2008:HOH:O	2.15	0.44
2:B:332:SER:O	2:B:336:ILE:HG13	2.18	0.44
2:D:362:CYS:SG	2:D:364:LEU:CD1	3.06	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:378:LYS:HA	2:D:379:PRO:HD3	1.88	0.44
1:A:21:TRP:CE2	1:A:28:TYR:HB2	2.54	0.42
1:A:58:VAL:HG23	1:A:59:ARG:HG3	2.01	0.42
1:C:41:ILE:HD12	2:D:348:GLU:HG3	2.02	0.42
1:C:43:ILE:CD1	2:D:344:LYS:HB2	2.30	0.41
1:C:14:ASP:OD1	1:C:54:HIS:CD2	2.65	0.41
1:C:26:SER:HB3	1:C:37:GLU:OE2	2.20	0.41
1:A:52:ASN:OD1	2:B:337:ASN:ND2	2.54	0.41
2:D:344:LYS:O	2:D:348:GLU:HB2	2.21	0.41
1:A:14:ASP:OD1	1:A:54:HIS:CD2	2.69	0.40
1:C:21:TRP:CE2	1:C:28:TYR:HB2	2.56	0.40
1:A:54:HIS:HE1	3:A:2013:HOH:O	2.04	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	59/65 (91%)	56 (95%)	3 (5%)	0	100	100
1	C	59/65 (91%)	56 (95%)	3 (5%)	0	100	100
2	B	88/136 (65%)	84 (96%)	4 (4%)	0	100	100
2	D	88/136 (65%)	86 (98%)	2 (2%)	0	100	100
All	All	294/402 (73%)	282 (96%)	12 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	Percentiles	
1	A	50/51 (98%)	49 (98%)	1 (2%)	55	77
1	C	50/51 (98%)	50 (100%)	0	100	100
2	B	68/98 (69%)	63 (93%)	5 (7%)	13	25
2	D	68/98 (69%)	62 (91%)	6 (9%)	10	18
All	All	236/298 (79%)	224 (95%)	12 (5%)	24	42

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	59	ARG
2	B	345	SER
2	B	353	ASP
2	B	371	ASP
2	B	375	LEU
2	B	396	LEU
2	D	332	SER
2	D	356	SER
2	D	361	THR
2	D	367	LYS
2	D	416	LEU
2	D	417	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	52	ASN
1	A	54	HIS
2	B	337	ASN
2	B	342	GLN
1	C	52	ASN
1	C	54	HIS
2	D	337	ASN
2	D	342	GLN
2	D	413	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

There are no ligands in this entry.

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, 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	61/65 (93%)	-0.29	0	100	100	41, 51, 72, 86	0
1	C	61/65 (93%)	-0.32	0	100	100	38, 51, 70, 87	0
2	B	90/136 (66%)	-0.15	0	100	100	42, 61, 85, 101	0
2	D	90/136 (66%)	-0.22	0	100	100	41, 61, 85, 94	0
All	All	302/402 (75%)	-0.23	0	100	100	38, 57, 84, 101	0

There are no RSRZ outliers to report.

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)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.