Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 07:35 PM UTC

PDB ID	:	6P0U / pdb_00006p0u
Title	:	Crystal structure of ternary DNA complex " FX(1-2)-2Xis" containing E. coli Fis and phage lambda Xis
Authors	:	Hancock, S.P.; Cascio, D.; Johnson, R.C.
Deposited on	:	2019-05-17
Resolution	:	3.30 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 types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

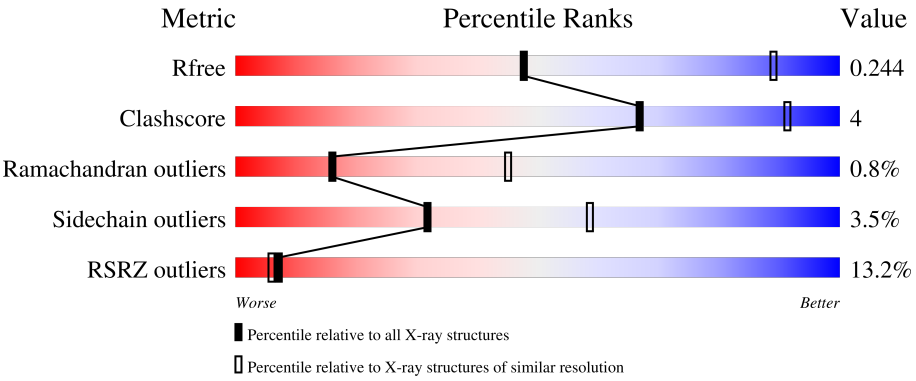
MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

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 3.30 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}	180053	1169 (3.32-3.28)
Clashscore	190562	1209 (3.32-3.28)
Ramachandran outliers	187476	1188 (3.32-3.28)
Sidechain outliers	187428	1187 (3.32-3.28)
RSRZ outliers	180081	1169 (3.32-3.28)

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	98	17% 79% 7% • 13%
1	B	98	18% 80% 6% 14%
2	C	27	74% 26%
3	D	27	74% 26%
4	E	55	5% 69% 25% 5%

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Mol	Chain	Length	Quality of chain
4	F	55	9% 73% 18% 7%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 3148 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 DNA-binding protein Fis.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	85	Total	C	N	O	S	0	0	0
			610	382	107	116	5			
1	B	84	Total	C	N	O	S	0	0	0
			595	374	101	116	4			

- Molecule 2 is a DNA chain called DNA (27-MER), FX1-2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	27	Total	C	N	O	P	0	0	0
			550	267	93	164	26			

- Molecule 3 is a DNA chain called DNA (27-MER), FX1-2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	D	27	Total	C	N	O	P	0	0	0
			551	266	103	156	26			

- Molecule 4 is a protein called Excisionase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	E	52	Total	C	N	O	S	0	0	0
			441	281	85	74	1			
4	F	51	Total	C	N	O	S	0	0	0
			401	258	70	72	1			

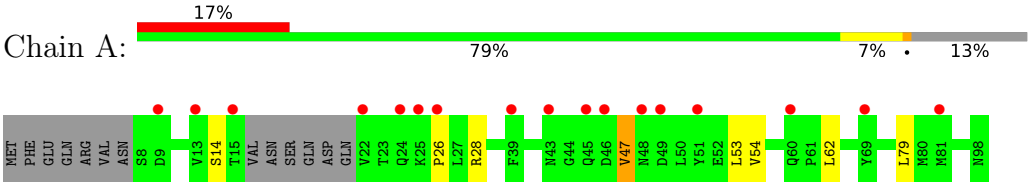
There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	28	SER	CYS	conflict	UNP P03699
F	28	SER	CYS	conflict	UNP P03699

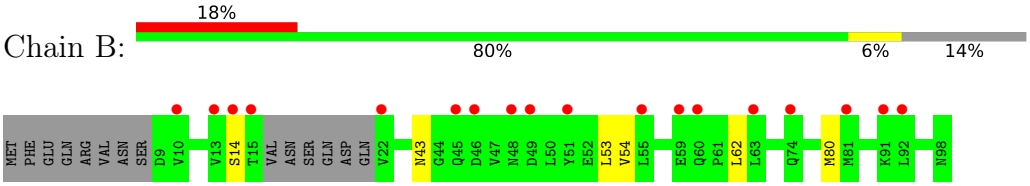
3 Residue-property plots (i)

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.

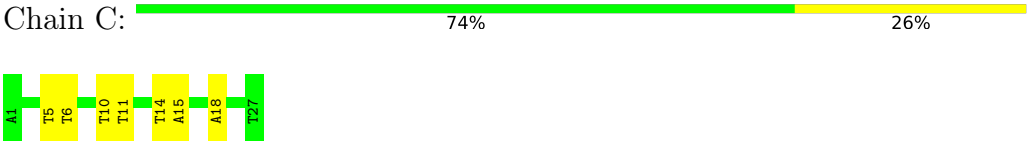
• Molecule 1: DNA-binding protein Fis



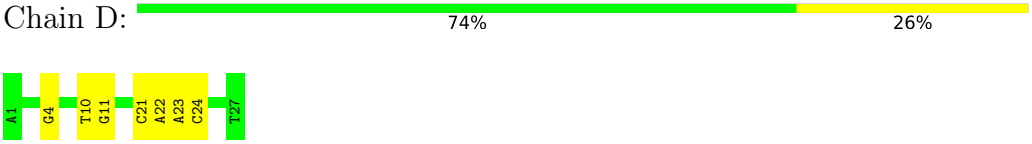
• Molecule 1: DNA-binding protein Fis



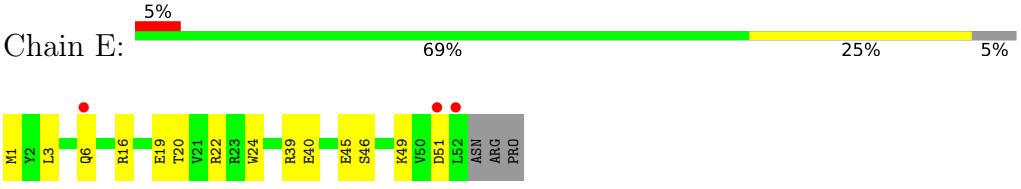
• Molecule 2: DNA (27-MER), FX1-2



• Molecule 3: DNA (27-MER), FX1-2



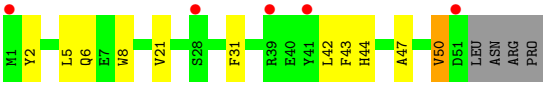
• Molecule 4: Excisionase



• Molecule 4: Excisionase

Chain F:


9%
73%
18%
7%


M1
Y2
L5
Q6
E7
W8
V21
S28
F31
R39
E40
Y41
L42
F43
H44
A47
V50
D51
LEU
ASN
ARG
PRO

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α, β, γ	151.85Å 151.85Å 120.17Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	75.92 – 3.30 75.92 – 3.30	Depositor EDS
% Data completeness (in resolution range)	96.0 (75.92-3.30) 96.0 (75.92-3.30)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.51 (at 3.33Å)	Xtriage
Refinement program	BUSTER 2.10.3	Depositor
R, R_{free}	0.192 , 0.219 0.222 , 0.244	Depositor DCC
R_{free} test set	1009 reflections (4.65%)	wwPDB-VP
Wilson B-factor (Å^2)	97.8	Xtriage
Anisotropy	0.733	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 119.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	3148	wwPDB-VP
Average B, all atoms (Å^2)	134.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.51% 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

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	0.92	0/614	1.48	4/831 (0.5%)
1	B	0.90	0/600	1.47	2/816 (0.2%)
2	C	0.47	0/615	0.74	0/948
3	D	0.46	0/619	0.64	0/953
4	E	0.94	1/453 (0.2%)	1.32	5/613 (0.8%)
4	F	0.93	0/412	1.42	5/564 (0.9%)
All	All	0.78	1/3313 (0.0%)	1.19	16/4725 (0.3%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	E	51	ASP	CA-C	6.64	1.61	1.52

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	F	50	VAL	N-CA-CB	-6.99	104.37	112.34
4	F	43	PHE	CA-CB-CG	6.35	120.15	113.80
4	E	6	GLN	CA-C-N	5.74	128.22	120.65
4	E	6	GLN	C-N-CA	5.74	128.22	120.65
1	B	53	LEU	CA-C-N	5.51	127.50	120.56
1	B	53	LEU	C-N-CA	5.51	127.50	120.56
1	A	53	LEU	CA-C-N	5.39	127.36	120.56
1	A	53	LEU	C-N-CA	5.39	127.36	120.56
4	E	19	GLU	CB-CG-CD	5.38	121.75	112.60
4	F	6	GLN	CA-C-N	5.37	128.25	120.79
4	F	6	GLN	C-N-CA	5.37	128.25	120.79
4	F	43	PHE	N-CA-C	-5.24	100.76	109.46
4	E	22	ARG	CA-C-N	5.23	127.54	120.38
4	E	22	ARG	C-N-CA	5.23	127.54	120.38
1	A	79	LEU	CA-C-N	5.03	126.97	120.44
1	A	79	LEU	C-N-CA	5.03	126.97	120.44

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	610	0	582	4	0
1	B	595	0	545	3	0
2	C	550	0	311	4	0
3	D	551	0	307	5	0
4	E	441	0	436	7	0
4	F	401	0	365	4	0
All	All	3148	0	2546	21	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 4.

All (21) 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)
4:E:16:ARG:HD2	4:E:24:TRP:CH2	2.32	0.64
4:E:16:ARG:HD2	4:E:24:TRP:HH2	1.65	0.62
1:A:47:VAL:HG11	1:B:80:MET:HE3	1.83	0.59
1:A:26:PRO:HB2	1:A:28:ARG:HG2	1.87	0.55
4:F:5:LEU:HD21	4:F:21:VAL:HB	1.91	0.53
4:E:24:TRP:CZ3	4:E:49:LYS:HD2	2.44	0.52
3:D:11:DG:H21	4:E:39:ARG:HG3	1.75	0.51
4:E:3:LEU:HD22	4:E:45:GLU:HA	1.92	0.50
2:C:10:DT:H2'	2:C:11:DT:C6	2.47	0.49
4:F:8:TRP:NE1	4:F:47:ALA:HB3	2.28	0.48
4:F:2:TYR:CE2	4:F:44:HIS:HB2	2.50	0.46
2:C:18:DA:H4'	4:E:40:GLU:HB3	1.99	0.45
1:A:54:VAL:HG21	1:B:62:LEU:HD13	2.00	0.43
3:D:23:DA:H2'	3:D:24:DC:O4'	2.18	0.43
3:D:21:DC:H2"	3:D:22:DA:C8	2.54	0.43
1:A:62:LEU:HD13	1:B:54:VAL:HG21	2.00	0.43
3:D:4:DG:OP2	4:E:16:ARG:HB3	2.19	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:F:31:PHE:O	4:F:47:ALA:HA	2.19	0.42
3:D:10:DT:H2'	3:D:11:DG:C8	2.54	0.41
2:C:5:DT:C6	2:C:6:DT:H72	2.55	0.41
2:C:14:DT:H2"	2:C:15:DA:C8	2.57	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	81/98 (83%)	75 (93%)	5 (6%)	1 (1%)	10 37
1	B	80/98 (82%)	75 (94%)	4 (5%)	1 (1%)	9 35
4	E	50/55 (91%)	49 (98%)	1 (2%)	0	100 100
4	F	49/55 (89%)	48 (98%)	1 (2%)	0	100 100
All	All	260/306 (85%)	247 (95%)	11 (4%)	2 (1%)	16 45

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	14	SER
1	B	14	SER

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	58/88 (66%)	57 (98%)	1 (2%)	53	71
1	B	55/88 (62%)	54 (98%)	1 (2%)	51	70
4	E	46/52 (88%)	43 (94%)	3 (6%)	15	43
4	F	39/52 (75%)	37 (95%)	2 (5%)	21	50
All	All	198/280 (71%)	191 (96%)	7 (4%)	32	58

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	47	VAL
1	B	43	ASN
4	E	1	MET
4	E	20	THR
4	E	46	SER
4	F	42	LEU
4	F	50	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	68	GLN
1	A	84	ASN
1	B	24	GLN
4	E	12	GLN
4	F	12	GLN

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

There are no ligands in this entry.

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, 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	<RSRZ>	#RSRZ>2	OWAB(Å^2)	Q<0.9
1	A	85/98 (86%)	1.05	17 (20%) 3 2	100, 135, 202, 219	0
1	B	84/98 (85%)	1.34	18 (21%) 2 2	116, 146, 199, 211	0
2	C	27/27 (100%)	-0.25	0 100 100	106, 132, 158, 171	0
3	D	27/27 (100%)	-0.40	0 100 100	112, 130, 172, 177	0
4	E	52/55 (94%)	0.45	3 (5%) 29 19	87, 99, 123, 135	0
4	F	51/55 (92%)	0.66	5 (9%) 13 10	92, 116, 142, 156	0
All	All	326/360 (90%)	0.74	43 (13%) 7 6	87, 130, 195, 219	0

All (43) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	46	ASP	6.1
1	B	49	ASP	5.5
1	B	13	VAL	4.8
1	A	49	ASP	4.8
1	A	24	GLN	4.6
1	B	63	LEU	4.4
4	E	52	LEU	4.3
1	B	15	THR	4.2
1	B	59	GLU	4.1
1	B	51	TYR	4.0
1	B	55	LEU	3.9
1	A	9	ASP	3.7
4	F	1	MET	3.7
1	A	15	THR	3.6
1	B	22	VAL	3.6
4	F	39	ARG	3.5
1	B	45	GLN	3.3
1	A	48	ASN	3.2
4	E	51	ASP	3.2

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Mol	Chain	Res	Type	RSRZ
1	B	74	GLN	3.0
1	B	60	GLN	2.8
1	A	25	LYS	2.8
1	B	48	ASN	2.8
1	A	22	VAL	2.7
1	B	91	LYS	2.6
1	B	10	VAL	2.6
1	A	51	TYR	2.6
4	F	51	ASP	2.6
1	B	81	MET	2.5
1	A	26	PRO	2.5
1	A	13	VAL	2.5
4	F	41	TYR	2.4
1	A	43	ASN	2.3
1	A	81	MET	2.3
1	A	69	TYR	2.3
1	B	92	LEU	2.3
1	B	14	SER	2.2
4	F	28	SER	2.2
4	E	6	GLN	2.1
1	A	45	GLN	2.1
1	A	39	PHE	2.1
1	A	60	GLN	2.1
1	A	46	ASP	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 oligosaccharides in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.