



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 11, 2024 – 01:44 PM EST

PDB ID : 3COA
Title : Crystal Structure of FoxO1 DBD Bound to IRE DNA
Authors : Brent, M.M.; Anand, R.; Marmorstein, R.
Deposited on : 2008-03-27
Resolution : 2.20 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 : 4.02b-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

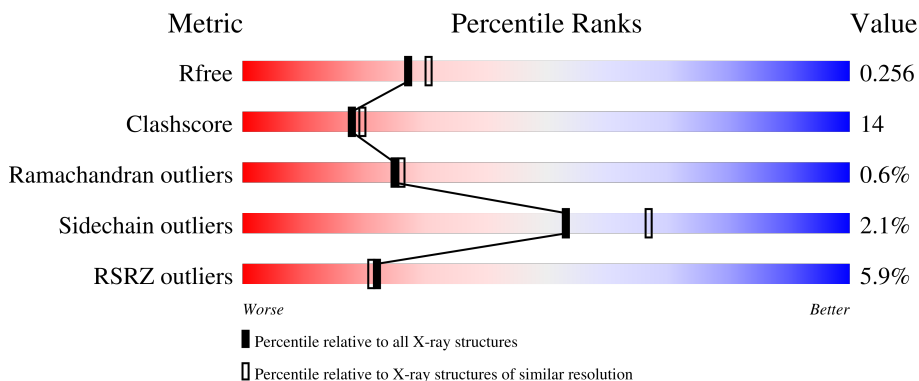
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)

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 $\leq 5\%$. 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	16	62% (green), 38% (yellow)
1	D	16	44% (green), 56% (yellow)
2	B	16	50% (green), 50% (yellow)
2	E	16	44% (green), 56% (yellow)
3	C	117	5% (red), 64% (green), 9% (yellow), 26% (grey)

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
3	F	117	 <p>A horizontal bar chart representing the quality of chain. The bar is divided into four segments: a small red segment at the beginning labeled '7%', a large green segment labeled '53%', a yellow segment labeled '21%', and a grey segment at the end labeled '26%'. A small black dot is visible on the boundary between the yellow and grey segments.</p>

2 Entry composition i

There are 5 unique types of molecules in this entry. The entry contains 2887 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 DNA chain called DNA (5'-D(*DTP*DGP*DGP*DTP*DTP*DTP*DGP*DTP*DTP*DTP*DTP*DGP*DCP*DTP*DTP*DG)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	A	16	Total 326	C 159	N 48	O 104	P 15	0	0	0
1	D	16	Total 326	C 159	N 48	O 104	P 15	0	0	0

- Molecule 2 is a DNA chain called DNA (5'-D(*DCP*DAP*DAP*DGP*DCP*DAP*DAP*DAP*DAP*DCP*DAP*DAP*DAP*DCP*DCP*DA)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	B	16	Total 324	C 155	N 70	O 84	P 15	0	0	0
2	E	16	Total 324	C 155	N 70	O 84	P 15	0	0	0

- Molecule 3 is a protein called Forkhead box protein O1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	86	Total 689	C 436	N 124	O 127	S 2	0	0	0
3	F	87	Total 689	C 436	N 125	O 126	S 2	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	150	SER	-	expression tag	UNP Q12778
F	150	SER	-	expression tag	UNP Q12778

- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	C	1	Total Ca 1 1	0	0
4	F	1	Total Ca 1 1	0	0

- Molecule 5 is water.

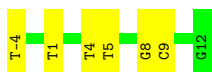
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	23	Total O 23 23	0	0
5	B	23	Total O 23 23	0	0
5	D	33	Total O 33 33	0	0
5	E	24	Total O 24 24	0	0
5	C	53	Total O 53 53	0	0
5	F	51	Total O 51 51	0	0

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: DNA (5'-D(*DTP*DGP*DGP*DTP*DTP*DTP*DGP*DTP*DTP*DTP*DTP*DG*DCP*DTP*DTP*DG)-3')

Chain A:  62% 38%



- Molecule 1: DNA (5'-D(*DTP*DGP*DGP*DTP*DTP*DTP*DGP*DTP*DTP*DTP*DTP*DG*DCP*DTP*DTP*DG)-3')

Chain D:  44% 56%



- Molecule 2: DNA (5'-D(*DCP*DAP*DAP*DGP*DCP*DAP*DAP*DAP*DAP*DCP*DAP*DAP*DAP*DCP*DCP*DA)-3')

Chain B:  50% 50%



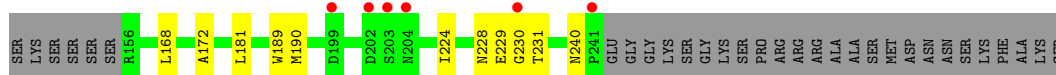
- Molecule 2: DNA (5'-D(*DCP*DAP*DAP*DGP*DCP*DAP*DAP*DAP*DAP*DCP*DAP*DAP*DAP*DCP*DCP*DA)-3')

Chain E:  44% 56%

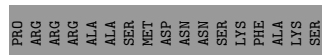
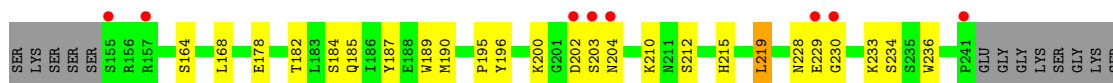


- Molecule 3: Forkhead box protein O1

Chain C:  5% 64% 9% 26%



● Molecule 3: Forkhead box protein O1



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	76.06Å 102.43Å 65.45Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.20 30.06 – 2.21	Depositor EDS
% Data completeness (in resolution range)	95.4 (30.00-2.20) 97.7 (30.06-2.21)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.05 (at 2.20Å)	Xtrriage
Refinement program	CNS	Depositor
R, R_{free}	0.216 , 0.250 0.222 , 0.256	Depositor DCC
R_{free} test set	4804 reflections (9.75%)	wwPDB-VP
Wilson B-factor (Å ²)	28.5	Xtrriage
Anisotropy	0.552	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 38.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	2887	wwPDB-VP
Average B, all atoms (Å ²)	30.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 22.88 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 5.2081e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: CA

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	0.50	0/362	0.82	0/559
1	D	0.49	0/362	0.82	0/559
2	B	0.45	0/366	0.74	0/561
2	E	0.49	0/366	0.75	0/561
3	C	0.47	0/707	0.64	0/956
3	F	0.47	0/707	0.66	0/956
All	All	0.48	0/2870	0.73	0/4152

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	326	0	188	8	0
1	D	326	0	188	8	0
2	B	324	0	178	9	0
2	E	324	0	178	12	0
3	C	689	0	662	10	1
3	F	689	0	659	18	1
4	C	1	0	0	0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	F	1	0	0	0	0
5	A	23	0	0	0	0
5	B	23	0	0	0	0
5	C	53	0	0	0	0
5	D	33	0	0	1	0
5	E	24	0	0	0	0
5	F	51	0	0	4	0
All	All	2887	0	2053	64	2

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 14.

All (64) 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)
2:B:15:DA:H2''	2:B:16:DG:H5'	1.50	0.93
2:B:21:DA:H2''	2:B:22:DC:H5'	1.49	0.92
2:E:15:DA:H2''	2:E:16:DG:H5''	1.52	0.92
1:D:4:DT:H2''	1:D:5:DT:H5'	1.54	0.85
2:B:15:DA:H2''	2:B:16:DG:C5'	2.18	0.74
1:A:4:DT:H2''	1:A:5:DT:C5'	2.19	0.72
2:E:19:DA:H2''	2:E:20:DA:C5'	2.20	0.72
2:E:19:DA:H2''	2:E:20:DA:H5'	1.72	0.71
1:A:4:DT:H2''	1:A:5:DT:H5'	1.73	0.70
1:D:4:DT:H2''	1:D:5:DT:C5'	2.22	0.69
3:C:229:GLU:HG2	3:C:229:GLU:O	1.95	0.66
2:B:21:DA:H2''	2:B:22:DC:C5'	2.24	0.64
3:C:224:ILE:HG23	3:C:240:ASN:HB2	1.80	0.63
2:E:15:DA:C2'	2:E:16:DG:H5''	2.28	0.63
3:C:228:ASN:OD1	3:C:229:GLU:N	2.32	0.62
3:F:228:ASN:OD1	3:F:229:GLU:N	2.35	0.60
2:B:25:DA:H1'	2:B:26:DC:H5''	1.83	0.59
2:E:13:DC:H2''	2:E:14:DA:C8	2.38	0.58
3:F:168:LEU:HB3	3:F:190:MET:HE1	1.85	0.57
3:F:168:LEU:HB3	3:F:190:MET:CE	2.34	0.57
1:D:8:DG:H1'	1:D:9:DC:H5''	1.87	0.56
3:F:228:ASN:HB2	3:F:234:SER:O	2.08	0.54
2:E:25:DA:H2''	2:E:26:DC:H5'	1.90	0.53
2:E:25:DA:H1'	2:E:26:DC:H5''	1.90	0.53
3:F:230:GLY:HA3	3:F:233:LYS:HD2	1.90	0.53
1:A:4:DT:H2''	1:A:5:DT:H5''	1.91	0.52

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:F:195:PRO:HG2	5:F:284:HOH:O	2.09	0.52
1:A:8:DG:H2''	1:A:9:DC:H5'	1.93	0.51
1:A:4:DT:C2'	1:A:5:DT:H5''	2.42	0.50
2:E:17:DC:OP1	3:F:164:SER:HA	2.11	0.50
3:F:178:GLU:HG3	5:F:286:HOH:O	2.12	0.49
3:F:196:TYR:CZ	3:F:200:LYS:HE2	2.48	0.49
2:B:25:DA:H2''	2:B:26:DC:C5'	2.44	0.48
1:D:-1:DT:H6	1:D:-1:DT:H5'	1.78	0.48
3:F:215:HIS:O	3:F:219:LEU:HB2	2.14	0.48
3:F:187:TYR:CE1	3:F:210:LYS:HG2	2.49	0.47
2:E:19:DA:C2'	2:E:20:DA:H5''	2.45	0.47
1:A:4:DT:H1'	1:A:5:DT:H5''	1.97	0.47
2:E:25:DA:H2''	2:E:26:DC:C5'	2.44	0.47
2:E:19:DA:H2''	2:E:20:DA:H5''	1.95	0.47
3:F:229:GLU:CD	3:F:236:TRP:HE1	2.17	0.47
3:F:182:THR:OG1	3:F:185:GLN:HG3	2.15	0.46
3:C:168:LEU:HB3	3:C:190:MET:CE	2.46	0.45
3:C:189:TRP:CZ3	3:C:190:MET:HE1	2.52	0.45
2:E:19:DA:H1'	2:E:20:DA:H5''	1.99	0.45
1:D:4:DT:C2'	1:D:5:DT:C5'	2.95	0.44
1:D:-4:DT:H2''	1:D:-3:DG:C8	2.52	0.44
3:F:189:TRP:CE3	3:F:190:MET:HE2	2.53	0.44
1:A:-4:DT:H5'	1:A:-4:DT:H6	1.82	0.44
1:D:1:DT:H2''	1:D:2:DT:C5'	2.48	0.44
2:B:13:DC:H2''	2:B:14:DA:C8	2.54	0.43
3:C:172:ALA:O	3:C:181:LEU:HD11	2.19	0.43
2:B:15:DA:C2'	2:B:16:DG:C5'	2.94	0.42
3:C:230:GLY:HA2	5:F:308:HOH:O	2.19	0.42
3:C:189:TRP:HZ3	3:C:190:MET:HE1	1.83	0.42
2:B:25:DA:H2''	2:B:26:DC:H5'	2.02	0.42
1:D:8:DG:H2''	1:D:9:DC:H5'	2.03	0.41
3:F:229:GLU:OE2	3:F:236:TRP:NE1	2.54	0.41
3:C:168:LEU:HB3	3:C:190:MET:HE1	2.03	0.41
1:A:1:DT:H5'	1:A:1:DT:H6	1.86	0.41
5:D:16:HOH:O	3:F:184:SER:HB2	2.22	0.40
3:C:230:GLY:CA	5:F:308:HOH:O	2.68	0.40
3:F:189:TRP:CZ3	3:F:190:MET:HE2	2.57	0.40
3:F:202:ASP:O	3:F:203:SER:C	2.60	0.40

All (2) 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)
3:C:229:GLU:CB	3:C:229:GLU:CB[2_555]	1.88	0.32
3:F:229:GLU:CB	3:F:229:GLU:CB[2_555]	2.06	0.14

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	
3	C	84/117 (72%)	84 (100%)	0	0	100	100
3	F	85/117 (73%)	82 (96%)	2 (2%)	1 (1%)	13	10
All	All	169/234 (72%)	166 (98%)	2 (1%)	1 (1%)	25	26

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	F	204	ASN

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	
3	C	73/101 (72%)	72 (99%)	1 (1%)	67	80
3	F	72/101 (71%)	70 (97%)	2 (3%)	43	56
All	All	145/202 (72%)	142 (98%)	3 (2%)	53	67

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	C	231	THR
3	F	212	SER
3	F	219	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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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	16/16 (100%)	-0.01	0 100 100	17, 33, 54, 58	0
1	D	16/16 (100%)	0.01	0 100 100	18, 29, 51, 60	0
2	B	16/16 (100%)	-0.27	0 100 100	22, 33, 45, 46	0
2	E	16/16 (100%)	-0.26	0 100 100	23, 33, 45, 47	0
3	C	86/117 (73%)	0.24	6 (6%) 16 15	12, 24, 47, 51	0
3	F	87/117 (74%)	0.32	8 (9%) 9 7	13, 23, 48, 51	0
All	All	237/298 (79%)	0.17	14 (5%) 22 21	12, 27, 48, 60	0

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	C	204	ASN	4.3
3	F	241	PRO	3.9
3	F	204	ASN	3.1
3	F	155	SER	2.9
3	C	202	ASP	2.7
3	C	199	ASP	2.6
3	F	230	GLY	2.6
3	C	203	SER	2.5
3	C	241	PRO	2.4
3	F	229	GLU	2.4
3	F	157	ARG	2.3
3	F	203	SER	2.3
3	F	202	ASP	2.1
3	C	230	GLY	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, 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
4	CA	F	2	1/1	0.92	0.23	55,55,55,55	0
4	CA	C	1	1/1	0.93	0.10	50,50,50,50	0

6.5 Other polymers [i](#)

There are no such residues in this entry.