



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 02:47 AM UTC

PDB ID : 4PKY / pdb_00004pky
Title : ARNT/HIF transcription factor/coactivator complex
Authors : Tomchick, D.R.; Partch, C.L.; Gardner, K.H.
Deposited on : 2014-05-15
Resolution : 3.20 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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
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

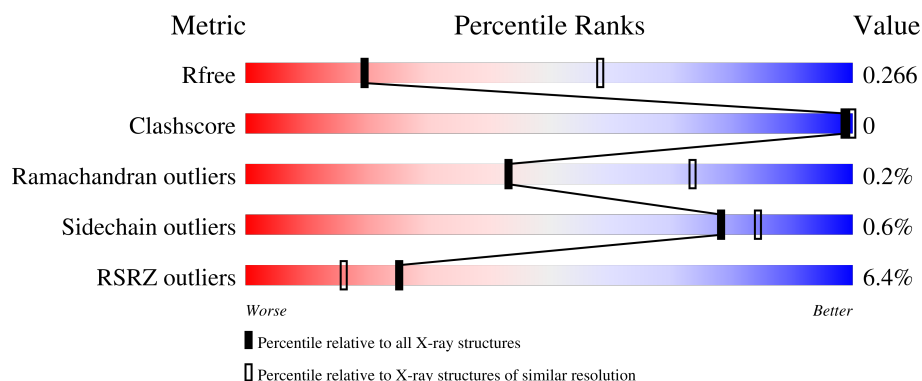
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.20 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}	180053	1466 (3.20-3.20)
Clashscore	190562	1573 (3.20-3.20)
Ramachandran outliers	187476	1548 (3.20-3.20)
Sidechain outliers	187428	1547 (3.20-3.20)
RSRZ outliers	180081	1466 (3.20-3.20)

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	121	
1	D	121	
2	B	50	
2	C	50	
2	E	50	

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Mol	Chain	Length	Quality of chain
2	F	50	8% 96%
3	G	117	9% 84% 15%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 8101 atoms, of which 4009 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 Aryl hydrocarbon receptor nuclear translocator.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	101	Total	C	H	N	O	S	0	0	0
			1658	540	811	149	153	5			
1	D	101	Total	C	H	N	O	S	0	0	0
			1660	541	814	149	151	5			

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	350	GLY	-	expression tag	UNP P27540
A	351	GLU	-	expression tag	UNP P27540
A	352	PHE	-	expression tag	UNP P27540
A	353	LYS	-	expression tag	UNP P27540
A	354	GLY	-	expression tag	UNP P27540
A	355	LEU	-	expression tag	UNP P27540
A	362	ARG	GLU	engineered mutation	UNP P27540
D	350	GLY	-	expression tag	UNP P27540
D	351	GLU	-	expression tag	UNP P27540
D	352	PHE	-	expression tag	UNP P27540
D	353	LYS	-	expression tag	UNP P27540
D	354	GLY	-	expression tag	UNP P27540
D	355	LEU	-	expression tag	UNP P27540
D	362	ARG	GLU	engineered mutation	UNP P27540

- Molecule 2 is a protein called Transforming acidic coiled-coil-containing protein 3.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	49	Total	C	H	N	O	S	0	0	0
			808	247	410	67	80	4			
2	C	47	Total	C	H	N	O	S	0	0	0
			767	235	386	64	78	4			
2	E	50	Total	C	H	N	O	S	0	0	0
			814	249	412	68	81	4			

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Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	F	49	Total	C	H	N	O	S	0	0	0
			807	247	409	67	80	4			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	582	GLY	-	expression tag	UNP Q9JJ11
B	583	GLU	-	expression tag	UNP Q9JJ11
B	584	PHE	-	expression tag	UNP Q9JJ11
C	582	GLY	-	expression tag	UNP Q9JJ11
C	583	GLU	-	expression tag	UNP Q9JJ11
C	584	PHE	-	expression tag	UNP Q9JJ11
E	582	GLY	-	expression tag	UNP Q9JJ11
E	583	GLU	-	expression tag	UNP Q9JJ11
E	584	PHE	-	expression tag	UNP Q9JJ11
F	582	GLY	-	expression tag	UNP Q9JJ11
F	583	GLU	-	expression tag	UNP Q9JJ11
F	584	PHE	-	expression tag	UNP Q9JJ11

- Molecule 3 is a protein called Endothelial PAS domain-containing protein 1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	G	100	Total	C	H	N	O	S	0	0	0
			1577	512	767	134	155	9			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
G	234	GLY	-	expression tag	UNP Q99814
G	235	GLU	-	expression tag	UNP Q99814
G	236	PHE	-	expression tag	UNP Q99814
G	237	LYS	-	expression tag	UNP Q99814
G	238	GLY	-	expression tag	UNP Q99814
G	247	GLU	ARG	engineered mutation	UNP Q99814

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).

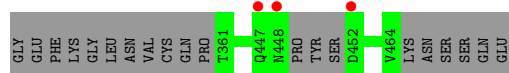
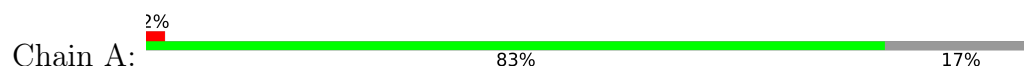


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		

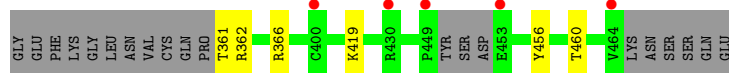
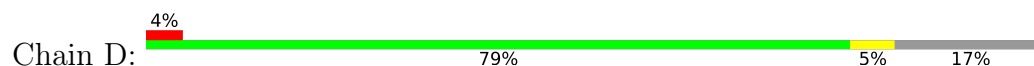
3 Residue-property plots [i](#)

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: Aryl hydrocarbon receptor nuclear translocator



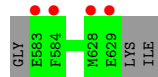
- Molecule 1: Aryl hydrocarbon receptor nuclear translocator



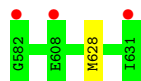
- Molecule 2: Transforming acidic coiled-coil-containing protein 3



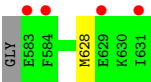
- Molecule 2: Transforming acidic coiled-coil-containing protein 3



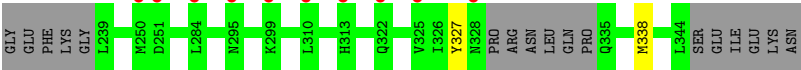
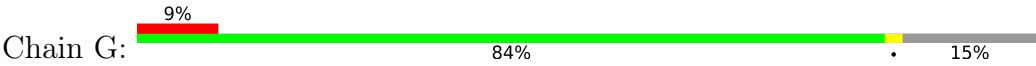
- Molecule 2: Transforming acidic coiled-coil-containing protein 3



- Molecule 2: Transforming acidic coiled-coil-containing protein 3



● Molecule 3: Endothelial PAS domain-containing protein 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	96.14Å 96.14Å 182.84Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.07 – 3.20 48.07 – 3.20	Depositor EDS
% Data completeness (in resolution range)	86.8 (48.07-3.20) 86.8 (48.07-3.20)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.49 (at 3.19Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.9_1690)	Depositor
R, R_{free}	0.231 , 0.270 0.231 , 0.266	Depositor DCC
R_{free} test set	626 reflections (4.23%)	wwPDB-VP
Wilson B-factor (Å ²)	52.7	Xtriage
Anisotropy	0.106	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 39.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	8101	wwPDB-VP
Average B, all atoms (Å ²)	56.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.90% of the height of the origin peak. No significant pseudotranslation is detected.*

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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SO4

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	0.45	0/865	0.72	0/1166
1	D	0.43	0/865	0.67	0/1167
2	B	0.63	0/399	0.89	0/531
2	C	0.54	0/382	0.72	0/509
2	E	0.66	0/403	0.76	0/536
2	F	0.59	0/399	0.83	0/531
3	G	0.44	0/827	0.64	0/1114
All	All	0.51	0/4140	0.73	0/5554

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

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	847	811	825	0	0
1	D	846	814	828	2	0
2	B	398	410	411	1	0
2	C	381	386	387	0	0
2	E	402	412	413	1	0
2	F	398	409	410	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	G	810	767	772	1	0
4	B	10	0	0	0	0
All	All	4092	4009	4046	4	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 0.

All (4) 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:D:362:ARG:HD3	1:D:460:THR:CG2	2.35	0.56
1:D:366:ARG:HD2	1:D:456:TYR:CG	2.44	0.52
2:B:598:MET:HE3	3:G:338:MET:HE2	2.02	0.42
2:E:628:MET:HE3	2:F:628:MET:HE2	2.03	0.41

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	97/121 (80%)	91 (94%)	6 (6%)	0	100	100
1	D	97/121 (80%)	94 (97%)	2 (2%)	1 (1%)	12	45
2	B	47/50 (94%)	47 (100%)	0	0	100	100
2	C	45/50 (90%)	45 (100%)	0	0	100	100
2	E	48/50 (96%)	47 (98%)	1 (2%)	0	100	100
2	F	47/50 (94%)	47 (100%)	0	0	100	100
3	G	96/117 (82%)	94 (98%)	2 (2%)	0	100	100
All	All	477/559 (85%)	465 (98%)	11 (2%)	1 (0%)	43	73

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	419	LYS

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	96/114 (84%)	96 (100%)	0	100	100
1	D	96/114 (84%)	95 (99%)	1 (1%)	68	80
2	B	46/46 (100%)	45 (98%)	1 (2%)	45	71
2	C	44/46 (96%)	44 (100%)	0	100	100
2	E	46/46 (100%)	46 (100%)	0	100	100
2	F	46/46 (100%)	46 (100%)	0	100	100
3	G	90/105 (86%)	89 (99%)	1 (1%)	65	79
All	All	464/517 (90%)	461 (99%)	3 (1%)	78	84

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

Mol	Chain	Res	Type
2	B	587	LEU
1	D	361	THR
3	G	327	TYR

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	414	GLN
1	A	447	GLN
1	D	367	HIS
1	D	413	GLN
2	F	599	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 [i](#)

2 ligands are modelled in this entry.

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	$\# Z > 2$
4	SO4	B	702	-	4,4,4	0.32	0	6,6,6	0.10	0
4	SO4	B	701	-	4,4,4	0.27	0	6,6,6	0.05	0

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 ⓘ

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	101/121 (83%)	0.36	3 (2%)	52 33	21, 37, 95, 111	0
1	D	101/121 (83%)	0.52	5 (4%)	34 22	29, 47, 82, 117	0
2	B	49/50 (98%)	0.43	3 (6%)	27 17	18, 34, 98, 134	0
2	C	47/50 (94%)	0.46	4 (8%)	16 11	22, 45, 93, 131	0
2	E	50/50 (100%)	0.39	3 (6%)	27 17	19, 33, 80, 101	0
2	F	49/50 (98%)	0.79	4 (8%)	17 11	28, 50, 91, 106	0
3	G	100/117 (85%)	0.99	10 (10%)	12 8	45, 77, 125, 144	0
All	All	497/559 (88%)	0.58	32 (6%)	25 16	18, 49, 106, 144	0

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	449	PRO	4.0
1	A	448	ASN	3.9
3	G	328	ASN	3.3
2	F	631	ILE	3.1
2	B	585	GLU	3.0
2	B	608	GLU	3.0
3	G	313	HIS	2.9
1	D	400	CYS	2.9
2	E	582	GLY	2.9
3	G	299	LYS	2.8
2	C	584	PHE	2.8
1	A	452	ASP	2.8
2	B	584	PHE	2.7
2	E	608	GLU	2.6
1	D	453	GLU	2.5
2	F	584	PHE	2.5
2	F	583	GLU	2.5

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Mol	Chain	Res	Type	RSRZ
3	G	250	MET	2.5
2	C	583	GLU	2.5
2	C	629	GLU	2.5
3	G	251	ASP	2.5
2	E	631	ILE	2.4
1	D	464	VAL	2.4
3	G	310	LEU	2.4
3	G	295	ASN	2.4
1	D	430	ARG	2.3
3	G	284	LEU	2.3
3	G	322	GLN	2.3
2	F	629	GLU	2.2
2	C	628	MET	2.1
1	A	447	GLN	2.1
3	G	325	VAL	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 oligosaccharides 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	SO4	B	702	5/5	0.89	0.24	52,52,52,52	0
4	SO4	B	701	5/5	0.90	0.11	52,52,52,52	0

6.5 Other polymers [i](#)

There are no such residues in this entry.