Integrative Structure Validation Report ❓

October 09, 2025 - 04:51 PM PDT

The following software was used in the production of this report:

IHMValidation Version 3.0
Python-IHM Version 2.5
MolProbity Version 4.5.2

PDB ID	9A9Y | pdb_00009a9y
Structure Title	Hypoxia Inducible Factor 2 complex bound to a TACC3 fragment (788-838)
Structure Authors	Closson, J.D.; Xu, X.; Gardner, K.H.
Deposited on	2025-05-19

This is a PDB-IHM Structure Validation Report.

We welcome your comments at helpdesk@pdb-ihm.org

A user guide is available at https://pdb-ihm.org/validation_help.html with specific help available everywhere you see the ❓ *symbol.*

List of references used to build this report is available here.

1. Overview ❓

1.1. Summary ❓

*This entry consists of 1 model(s). A total of 5 dataset(s) were used to build this entry.*

Name	Type	Count
3DEM volume	Experimental data	1
H/D exchange data	Experimental data	2
Experimental model	Starting model	1

Name	Type	Count
De Novo model	Starting model	1

1.2. Overall quality ?

This validation report contains model quality assessments for all structures, data quality and fit to model assessments for SAS and crosslinking-MS datasets. Data quality and fit to model assessments for other datasets and model uncertainty are under development. Number of plots is limited to 256.

Model Quality: MolProbity Analysis ?
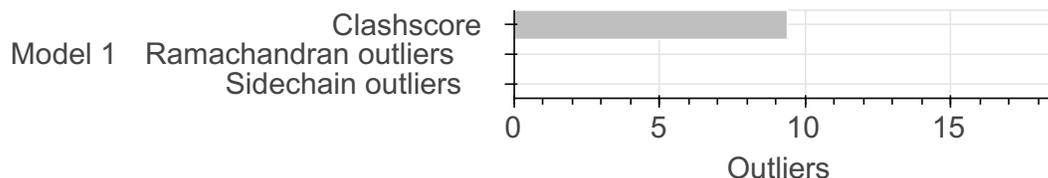
2. Model Details ?

2.1. Ensemble information ?

This entry consists of 0 distinct ensemble(s).

2.2. Representation ?

This entry has 1 representation(s).

ID	Model(s)	Entity ID	Molecule name	Chain(s) [auth]	Total residues	Rigid segments	Flexible segments	Model coverage/ Starting model coverage (%)	Scale
1	1	1	20 bp hypoxia response element (forward)	A [C]	21	-	1-21	100.00 / 100.00	Atomic
		2	20 bp hypoxia response element (reverse)	B [D]	21	-	1-21	100.00 / 100.00	Atomic
		3	Transforming acidic coiled-coil containing protein 3	C [E]	46	-	1-46	100.00 / 100.00	Atomic
				D [F]					
		4	Endothelial PAS domain-containing protein 1	E [A]	314	-	1-314	100.00 / 100.00	Atomic
		5	Aryl hydrocarbon receptor nuclear translocator	F [B]	268	-	1-268	100.00 / 100.00	Atomic

2.3. Datasets used for modeling ?

There are 5 unique datasets used to build the models in this entry.

ID	Dataset type	Database name	Data access code
1	3DEM volume	Zenodo	10.5281/zenodo.15579074

ID	Dataset type	Database name	Data access code
2	H/D exchange data	Zenodo	10.5281/zenodo.15585961
3	Experimental model	PDB	pdb_00009of0
4	De Novo model	AlphaFoldDB	AF-Q9Y6A5-F1
5	H/D exchange data	Zenodo	10.5281/zenodo.15585961

2.4. Methodology and software ❓

This entry is a result of 1 distinct protocol(s).

Step number	Protocol ID	Method name	Method type	Method description	Number of computed models	Multi state modeling	Multi scale modeling
1	1	CTF correction/Particle picking	Not available	WARP was used for CTF correction of micrographs and neural-network based particle picking	Not available	False	False
2	1	Particle classification/EM map reconstruction/Refinement	Not available	CryoSPARC was used to sort picked particles through 2D classification and reconstruct 3D EM maps	Not available	False	False
3	1	Model building	Not available	ChimeraX was used to rigidly fit a HIF-2 structure (9OF0) into the resulting EM map.	Not available	False	False
4	1	Rigid Docking	Not available	PHENIX dock-in-map was used to rigidly dock a TACC3 fragment against HIF-2 in unoccupied EM density	Not available	False	False

There are 4 software packages reported in this entry.

ID	Software name	Software version	Software classification	Software location
1	WARP	1.0.9	Particle Picking, CTF correction	https://github.com/warpem/warp
2	CryoSPARC	4.0.2	Data Processing	https://guide.cryosparc.com/
3	ChimeraX	1.90	Model Building	https://www.rbvi.ucsf.edu/chimerax/
4	PHENIX	1.20.1_4487	Validation, Docking	https://phenix-online.org/

3. Data quality ❓

3.3. 3DEM ❓

This section describes quality of the 3DEM datasets

3DEM dataset is not available in the EMDB database.

3.4. H/D exchange ❓

Validation for this section is under development.

4. Model quality ?

For models with atomic structures, MolProbity analysis is performed. For models with coarse-grained or multi-scale structures, excluded volume analysis is performed.

4.1b. MolProbity Analysis ?

Excluded volume satisfaction for the models in the entry are listed below. The Analysed column shows the number of particle-partice or particle-atom pairs for which excluded volume was analysed.

Standard geometry: bond outliers ?

There are 36 bond length outliers in this entry (0.55% of 6514 assessed bonds). A summary is provided below.

Chain	Res	Type	Atoms	|Z|	Observed (Å)	Ideal (Å)	Model ID (Worst)	Models (Total)
C	36	CYS	C-N	9.15	1.20	1.33	1	1
D	36	CYS	C-N	8.68	1.21	1.33	1	1
C	34	ARG	C-N	8.19	1.21	1.33	1	1
D	40	ILE	C-N	8.04	1.22	1.33	1	1
C	40	ILE	C-N	7.57	1.22	1.33	1	1
D	34	ARG	C-N	7.47	1.22	1.33	1	1
C	38	ASP	C-N	7.43	1.22	1.33	1	1
D	12	GLN	C-N	7.41	1.23	1.33	1	1
D	38	ASP	C-N	7.30	1.23	1.33	1	1
C	41	SER	C-N	6.98	1.23	1.33	1	1
D	41	SER	C-N	6.84	1.23	1.33	1	1
C	12	GLN	C-N	6.82	1.23	1.33	1	1
D	44	GLU	C-N	6.78	1.23	1.33	1	1
D	25	LYS	C-N	6.08	1.24	1.33	1	1
C	4	LEU	C-N	5.98	1.25	1.33	1	1
C	44	GLU	C-N	5.96	1.25	1.33	1	1
C	25	LYS	C-N	5.91	1.25	1.33	1	1
C	43	MET	C-N	5.81	1.25	1.33	1	1
D	4	LEU	C-N	5.59	1.25	1.33	1	1
C	13	MET	C-N	5.37	1.25	1.33	1	1
D	42	LYS	C-N	5.26	1.26	1.33	1	1
C	11	GLU	C-N	5.17	1.26	1.33	1	1
D	13	MET	C-N	4.99	1.26	1.33	1	1
C	42	LYS	C-N	4.92	1.26	1.33	1	1
D	9	ARG	C-N	4.92	1.26	1.33	1	1
D	39	LEU	C-N	4.91	1.26	1.33	1	1
D	11	GLU	C-N	4.87	1.26	1.33	1	1

Chain	Res	Type	Atoms	|Z|	Observed (Å)	Ideal (Å)	Model ID (Worst)	Models (Total)
C	31	GLU	C-N	4.77	1.26	1.33	1	1
C	9	ARG	C-N	4.72	1.26	1.33	1	1
D	37	ASP	C-N	4.59	1.26	1.33	1	1
D	43	MET	C-N	4.46	1.27	1.33	1	1
D	32	LEU	C-N	4.45	1.27	1.33	1	1
D	31	GLU	C-N	4.34	1.27	1.33	1	1
C	37	ASP	C-N	4.32	1.27	1.33	1	1
C	39	LEU	C-N	4.24	1.27	1.33	1	1
D	35	ILE	C-N	4.17	1.27	1.33	1	1

Standard geometry: angle outliers ?

There are no bond angle outliers.

Too-close contacts ?

The following all-atom clashscore is based on a MolProbity analysis. All-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The table below contains clashscores for all atomic models in this entry.

Model ID	Clash score	Number of clashes
1	9.39	115

There are 115 clashes. The table below contains the detailed list of all clashes based on a MolProbity analysis. Bad clashes are >= 0.4 Angstrom. The output is limited to 100 rows.

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
C:43:MET:HE2	D:43:MET:CB	1.16	1	1
C:43:MET:CE	D:43:MET:HB3	1.11	1	1
C:46:ILE:HG23	F:164:PRO:HA	0.99	1	1
C:43:MET:HE2	D:43:MET:HB3	0.90	1	1
A:19:DC:H2"	A:20:DG:H5"	0.88	1	1
F:170:ARG:NH2	F:179:PHE:HB2	0.82	1	1
A:3:DC:H2"	A:4:DT:H5"	0.81	1	1
F:207:GLU:N	F:207:GLU:OE1	0.80	1	1
C:46:ILE:HG23	F:164:PRO:CA	0.80	1	1
A:3:DC:H4'	A:4:DT:OP1	0.74	1	1
E:213:ASP:OD1	E:214:ASP:N	0.74	1	1
E:134:GLU:N	E:134:GLU:OE1	0.73	1	1
F:76:THR:O	F:76:THR:HG22	0.73	1	1
E:47:MET:HE1	F:21:LEU:HD22	0.72	1	1
F:106:VAL:HG11	F:114:LEU:HD11	0.72	1	1

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
C:46:ILE:CG2	F:164:PRO:HA	0.70	1	1
C:43:MET:HE2	D:43:MET:CG	0.70	1	1
A:17:DG:H1	B:6:DC:H42	0.70	1	1
B:2:DA:N7	B:3:DC:N4	0.70	1	1
F:106:VAL:HG21	F:114:LEU:HD12	0.69	1	1
E:100:MET:HE1	E:141:MET:HE2	0.69	1	1
C:22:VAL:HG13	D:25:LYS:HE3	0.68	1	1
E:244:MET:HA	E:244:MET:HE3	0.68	1	1
C:25:LYS:HE3	D:22:VAL:HG13	0.67	1	1
E:153:ASN:OD1	E:154:LEU:N	0.66	1	1
C:15:ILE:CD1	D:11:GLU:OE1	0.65	1	1
C:11:GLU:OE1	D:15:ILE:CD1	0.65	1	1
B:20:DG:H2"	B:21:DC:C5	0.65	1	1
A:3:DC:H2"	A:4:DT:C5'	0.65	1	1
A:15:DG:H2"	A:16:DG:OP2	0.64	1	1
B:1:DC:H4'	B:2:DA:OP1	0.62	1	1
A:20:DG:H2"	A:21:DT:C6	0.62	1	1
B:14:DT:H2"	B:15:DA:O5'	0.60	1	1
A:19:DC:N4	B:4:DG:O6	0.60	1	1
F:76:THR:HG22	F:78:ARG:HG2	0.59	1	1
E:168:VAL:HG12	E:177:LEU:HD13	0.59	1	1
F:170:ARG:CZ	F:179:PHE:HB2	0.58	1	1
E:79:PHE:HB2	E:93:SER:OG	0.58	1	1
A:20:DG:C8	A:20:DG:H5"	0.58	1	1
E:307:VAL:HG22	F:182:HIS:HE1	0.58	1	1
F:76:THR:CG2	F:78:ARG:HG2	0.57	1	1
A:11:DG:C2'	A:12:DT:H71	0.57	1	1
A:7:DG:C8	A:8:DT:H72	0.56	1	1
F:101:THR:HG23	F:104:ASP:H	0.55	1	1
B:2:DA:H8	B:2:DA:H5"	0.55	1	1
B:5:DA:H2'	B:6:DC:O4'	0.55	1	1
A:18:DT:H2"	A:19:DC:H6	0.55	1	1
F:148:TRP:CD1	F:154:CYS:HG	0.54	1	1
F:76:THR:CG2	F:76:THR:O	0.54	1	1
F:106:VAL:HG11	F:114:LEU:CD1	0.54	1	1

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
C:46:ILE:CG2	F:164:PRO:CA	0.54	1	1
B:6:DC:H2'	B:7:DC:C5	0.53	1	1
E:287:LEU:HG	E:287:LEU:O	0.53	1	1
B:15:DA:H2"	B:16:DC:C6	0.53	1	1
E:195:ASP:N	E:195:ASP:OD1	0.52	1	1
C:46:ILE:CG2	F:164:PRO:N	0.52	1	1
E:206:ASP:N	E:206:ASP:OD1	0.51	1	1
E:100:MET:CE	E:141:MET:HE2	0.51	1	1
A:19:DC:H2"	A:20:DG:C5'	0.51	1	1
F:173:ILE:O	F:173:ILE:HG22	0.51	1	1
E:60:LEU:CD1	F:52:LEU:HD22	0.51	1	1
E:307:VAL:HG22	F:182:HIS:CE1	0.51	1	1
F:170:ARG:CZ	F:179:PHE:CB	0.50	1	1
A:2:DG:C2'	A:3:DC:H5'	0.50	1	1
F:129:MET:HE3	F:139:VAL:HG11	0.50	1	1
B:3:DC:H1'	B:4:DG:C8	0.50	1	1
B:20:DG:H2"	B:21:DC:C6	0.50	1	1
B:15:DA:H2"	B:16:DC:H6	0.49	1	1
E:213:ASP:O	E:216:ILE:HG22	0.49	1	1
B:17:DG:H1'	B:18:DC:H5"	0.49	1	1
F:92:GLN:OE1	F:97:TRP:NE1	0.49	1	1
A:7:DG:O6	B:15:DA:N6	0.48	1	1
E:80:ILE:HG22	E:81:ALA:N	0.48	1	1
A:15:DG:C1'	A:16:DG:H5'	0.48	1	1
E:258:VAL:O	E:258:VAL:HG13	0.47	1	1
F:84:ASP:C	F:84:ASP:OD1	0.46	1	1
B:15:DA:C4	B:16:DC:C5	0.46	1	1
B:7:DC:H2"	B:8:DC:OP2	0.46	1	1
E:59:LEU:CD1	E:171:TYR:CE2	0.46	1	1
C:25:LYS:CE	D:22:VAL:HG13	0.45	1	1
A:15:DG:H1'	A:16:DG:H5'	0.45	1	1
A:15:DG:H1'	A:16:DG:C5'	0.45	1	1
C:22:VAL:HG13	D:25:LYS:CE	0.45	1	1
B:14:DT:H2"	B:15:DA:C5'	0.45	1	1
E:154:LEU:O	E:154:LEU:HD23	0.45	1	1

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
E:286:ASN:N	E:286:ASN:OD1	0.45	1	1
F:32:ASP:OD1	F:34:LEU:N	0.44	1	1
E:276:THR:HG23	E:296:ASN:OD1	0.44	1	1
E:154:LEU:C	E:154:LEU:HD23	0.44	1	1
A:10:DC:H41	F:11:ARG:NH2	0.44	1	1
A:12:DT:H2"	A:13:DG:C8	0.44	1	1
F:155:LEU:HD21	F:157:ALA:HB2	0.44	1	1
A:19:DC:C2'	A:20:DG:C8	0.43	1	1
E:213:ASP:C	E:213:ASP:OD1	0.43	1	1
B:16:DC:C2	B:17:DG:N7	0.43	1	1
A:20:DG:H2"	A:21:DT:C5	0.43	1	1
D:39:LEU:O	D:43:MET:HG2	0.42	1	1
A:19:DC:H2'	A:20:DG:C8	0.42	1	1
E:48:ARG:NH1	E:108:THR:O	0.42	1	1
A:11:DG:H2"	A:12:DT:H71	0.42	1	1

Torsion angles: Protein backbone ?

In the following table, Ramachandran outliers are listed. The Analysed column shows the number of residues for which the backbone conformation was analysed.

Model ID	Analysed	Favored	Allowed	Outliers
1	648	638	10	0

Torsion angles : Protein sidechains ?

In the following table, sidechain rotameric outliers are listed. The Analysed column shows the number of residues for which the sidechain conformation was analysed.

Model ID	Analysed	Favored	Allowed	Outliers
1	627	564	63	0

5. Fit to Data Used for Modeling Assessment ?

5.3. 3DEM

This section describes fit of models to the 3DEM data. Only results for the representative model, selected as a first model with the largest number of asymmetric units.

3DEM dataset is not available in the EMDB database.

5.4. H/D exchange ?

Validation for this section is under development.

6. Fit to Data Used for Validation Assessment 🟢

Validation for this section is under development.