Integrative Structure Validation Report

October 09, 2025 - 04:40 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
ATSAS Version 3.2.1 (r14885)

PDB ID	9A1Y | pdb_00009a1y
PDB-Dev ID	PDBDEV_00000128
Structure Title	Integrative model of Nucleotide excision repair complex of XPA and RPA on 3' junction substrate
Structure Authors	DSouza, A.; Topolska-Wos, A.M.; Chazin, W.J.
Deposited on	2022-06-27

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

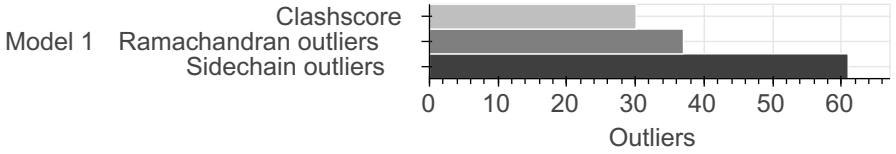
This entry consists of 1 model(s). A total of 7 dataset(s) were used to build this entry.

Name	Type	Count
SAS data	Experimental data	1
Integrative model	Starting model	1
Experimental model	Starting model	3
Comparative model	Starting model	1
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	RPA70	A	434	-	1-238, 239-253, 254-434	100.00 / 100.00	Atomic
		2	RPA32	B	226	-	1-128, 129-226	100.00 / 100.00	Atomic
		3	RPA14	C	115	-	1-115	100.00 / 100.00	Atomic
		4	XPA	D	239	-	1-28, 29-48, 49-97, 98-239	100.00 / 100.00	Atomic
		5	DNA (40-MER)	E	40	-	1-40	100.00 / 100.00	Atomic
		6	DNA (5'-D(P*TP*TP*TP*TP*TP*TP*TP*TP*GP*CP*CP*CP*GP*CP*GP*GP*C)-3')	F	17	-	1-17	100.00 / 100.00	Atomic
		7	ZINC ION	G [E] H	Non-polymeric	-	-	Not available / Not available	Atomic

2.3. Datasets used for modeling

There are 7 unique datasets used to build the models in this entry.

ID	Dataset type	Database name	Data access code
1	SAS data	SASBDB	SASDH44
2	Experimental model	PDB	pdb_00001jmc
3	Integrative model	PDB	pdb_00009a03
4	Experimental model	PDB	pdb_0000111o
5	Experimental model	PDB	pdb_00001dpu
6	Comparative model	Not available	Not available

ID	Dataset type	Database name	Data access code
7	De Novo model	Not available	Not available

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	Not available	Not available	Not available	1	False	False

There are 2 software packages reported in this entry.

ID	Software name	Software version	Software classification	Software location
1	Modeller	9v4	model building	https://salilab.org/modeller/
2	FoXSDock	main.c2a7893	model building	https://modbase.compbio.ucsf.edu/foxsdock/

3. Data quality

3.1.1. Scattering profile

SAS data used in this integrative model could not be validated as the sasCIF file is currently unavailable or incomplete.

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 306 bond length outliers in this entry (3.26% of 9393 assessed bonds). A summary is provided below. The output is limited to 100 rows.

Chain	Res	Type	Atoms	|Z|	Observed (Å)	Ideal (Å)	Model ID (Worst)	Models (Total)
F	1	DT	O3'-P	90.87	2.97	1.61	1	1
A	179	TRP	NE1-CE2	56.21	0.75	1.37	1	1
A	34	ARG	NE-CZ	38.82	1.75	1.33	1	1
B	207	ASN	C-N	37.13	1.85	1.33	1	1
D	98	MET	C-N	28.89	1.73	1.33	1	1
B	128	LYS	C-N	24.08	1.67	1.33	1	1
A	34	ARG	CZ-NH2	22.45	1.04	1.33	1	1
D	19	GLU	C-N	20.27	1.61	1.33	1	1
E	24	DC	C5'-C4'	19.73	1.91	1.52	1	1
A	422	ARG	CD-NE	18.83	1.72	1.46	1	1
A	179	TRP	CD2-CE2	17.55	1.11	1.41	1	1
D	20	LEU	CA-C	17.38	1.89	1.52	1	1
D	20	LEU	N-CA	16.59	1.77	1.46	1	1
D	172	HIS	CE1-NE2	16.57	1.49	1.32	1	1
A	203	ASP	CA-CB	15.78	1.85	1.53	1	1
B	207	ASN	CA-CB	15.40	1.84	1.53	1	1

Chain	Res	Type	Atoms	|Z|	Observed (Å)	Ideal (Å)	Model ID (Worst)	Models (Total)
B	129	ASN	C-N	15.31	1.54	1.33	1	1
A	3	VAL	CA-CB	15.25	1.13	1.54	1	1
A	179	TRP	CD1-NE1	15.03	1.69	1.37	1	1
B	133	SER	C-N	14.41	1.53	1.33	1	1
B	130	SER	N-CA	13.95	1.72	1.46	1	1
B	130	SER	CA-C	13.46	1.81	1.52	1	1
B	129	ASN	CA-C	13.18	1.80	1.52	1	1
E	20	DC	N3-C4	13.10	1.60	1.33	1	1
E	24	DC	C3'-C2'	12.89	1.27	1.52	1	1
D	20	LEU	CA-CB	12.68	1.78	1.53	1	1
B	129	ASN	N-CA	12.09	1.69	1.46	1	1
B	134	ALA	N-CA	11.87	1.68	1.46	1	1
B	132	PRO	C-N	11.58	1.49	1.33	1	1
D	100	PHE	CD1-CE1	11.57	1.73	1.38	1	1
D	18	ALA	C-N	11.45	1.49	1.33	1	1
A	179	TRP	CD2-CE3	11.34	1.22	1.40	1	1
B	133	SER	CA-C	11.25	1.76	1.52	1	1
B	134	ALA	CA-C	10.88	1.75	1.52	1	1
E	20	DC	C2-N3	10.73	1.57	1.36	1	1
B	136	ARG	C-N	10.52	1.48	1.33	1	1
E	14	DC	P-O5'	10.32	1.39	1.60	1	1
E	21	DC	C2'-C1'	10.21	1.73	1.52	1	1
A	4	PRO	N-CD	10.15	1.62	1.47	1	1
B	132	PRO	N-CA	10.14	1.62	1.47	1	1
A	422	ARG	CG-CD	10.13	1.82	1.52	1	1
D	18	ALA	CA-C	10.11	1.74	1.52	1	1
E	24	DC	C4'-C3'	10.05	1.32	1.52	1	1
E	13	DC	C2'-C1'	9.86	1.33	1.52	1	1
E	20	DC	C2-O2	9.51	1.05	1.24	1	1
E	21	DC	C2-N3	9.48	1.55	1.36	1	1
B	135	GLY	N-CA	9.47	1.60	1.45	1	1
D	21	PRO	C-N	9.43	1.46	1.33	1	1
A	161	LYS	CA-CB	9.12	1.35	1.53	1	1
B	132	PRO	CA-C	8.96	1.71	1.52	1	1
A	34	ARG	CZ-NH1	8.92	1.45	1.32	1	1
A	2	VAL	C-O	8.90	1.41	1.23	1	1
B	206	SER	C-N	8.70	1.45	1.33	1	1
A	1	LYS	CA-CB	8.66	1.70	1.53	1	1
B	134	ALA	C-N	8.65	1.45	1.33	1	1
A	179	TRP	CZ3-CH2	8.64	1.62	1.40	1	1
E	24	DC	C4'-O4'	8.58	1.62	1.45	1	1
A	427	SER	C-N	8.47	1.45	1.33	1	1

Chain	Res	Type	Atoms	|Z|	Observed (Å)	Ideal (Å)	Model ID (Worst)	Models (Total)
E	21	DC	O4'-C1'	8.30	1.25	1.41	1	1
B	135	GLY	CA-C	8.18	1.66	1.52	1	1
D	20	LEU	C-N	8.17	1.47	1.34	1	1
A	2	VAL	CA-C	8.17	1.35	1.52	1	1
A	3	VAL	C-O	8.14	1.39	1.23	1	1
E	24	DC	N1-C6	8.12	1.20	1.36	1	1
A	348	THR	N-CA	8.06	1.61	1.46	1	1
A	178	LEU	C-N	8.01	1.44	1.33	1	1
D	22	ALA	C-N	7.82	1.44	1.33	1	1
A	179	TRP	CE2-CZ2	7.70	1.56	1.39	1	1
D	21	PRO	CA-C	7.70	1.69	1.52	1	1
A	203	ASP	CG-OD2	7.65	1.10	1.25	1	1
B	133	SER	N-CA	7.58	1.60	1.46	1	1
D	20	LEU	CG-CD2	7.57	1.77	1.52	1	1
A	179	TRP	CE3-CZ3	7.52	1.16	1.38	1	1
B	131	GLN	C-N	7.47	1.46	1.34	1	1
D	18	ALA	C-O	7.47	1.08	1.23	1	1
D	112	PHE	CG-CD2	7.43	1.54	1.38	1	1
F	7	DT	O3'-P	7.41	1.50	1.61	1	1
E	24	DC	C2'-C1'	7.39	1.38	1.52	1	1
A	177	THR	CB-OG1	7.31	1.32	1.43	1	1
F	6	DT	O3'-P	7.29	1.50	1.61	1	1
A	203	ASP	C-N	7.28	1.43	1.33	1	1
D	100	PHE	CG-CD2	7.18	1.23	1.38	1	1
E	12	DC	C1'-N1	7.18	1.71	1.49	1	1
A	418	ARG	CD-NE	7.17	1.56	1.46	1	1
F	5	DT	P-O5'	6.96	1.46	1.60	1	1
A	2	VAL	C-N	6.87	1.43	1.33	1	1
F	5	DT	O3'-P	6.73	1.51	1.61	1	1
F	5	DT	C5'-C4'	6.61	1.39	1.52	1	1
D	21	PRO	N-CA	6.55	1.56	1.47	1	1
B	135	GLY	C-N	6.53	1.42	1.33	1	1
E	24	DC	N1-C2	6.48	1.53	1.40	1	1
A	111	HIS	CG-ND1	6.47	1.45	1.38	1	1
B	39	HIS	CE1-NE2	6.44	1.39	1.32	1	1
E	12	DC	N1-C2	6.39	1.53	1.40	1	1
B	63	GLN	C-N	6.35	1.42	1.33	1	1
B	85	VAL	C-N	6.34	1.42	1.33	1	1
A	3	VAL	CA-C	6.32	1.66	1.52	1	1
A	34	ARG	N-CA	6.31	1.58	1.46	1	1
D	112	PHE	CG-CD1	6.30	1.52	1.38	1	1
A	157	ARG	CA-CB	6.28	1.66	1.53	1	1

Standard geometry: angle outliers

There are 973 bond angle outliers in this entry (7.54% of 12897 assessed bonds). A summary is provided below. The output is limited to 100 rows.

Chain	Res	Type	Atoms	|Z|	Observed (Å)	Ideal (Å)	Model ID (Worst)	Models (Total)
E	19	DC	C5'-C4'-C3'	37.20	170.70	114.90	1	1
E	20	DC	C5'-C4'-C3'	36.75	170.02	114.90	1	1
D	239	THR	O-C-OXT	33.94	16.19	118.00	1	1
E	19	DC	P-O5'-C5'	32.84	169.25	120.00	1	1
A	179	TRP	CG-CD1-NE1	32.01	68.59	110.20	1	1
E	17	DC	C3'-O3'-P	31.95	168.13	120.20	1	1
A	179	TRP	CE3-CZ3-CH2	28.92	83.51	121.10	1	1
A	179	TRP	CD2-CE3-CZ3	28.88	156.15	118.60	1	1
B	128	LYS	CA-C-O	27.81	168.08	120.80	1	1
D	100	PHE	CG-CD1-CE1	26.29	165.40	120.70	1	1
E	18	DC	C3'-O3'-P	25.31	158.16	120.20	1	1
D	18	ALA	C-N-CA	25.27	167.18	121.70	1	1
D	19	GLU	C-N-CA	24.08	165.05	121.70	1	1
E	13	DC	C5'-C4'-C3'	23.98	150.88	114.90	1	1
E	20	DC	C2-N3-C4	22.30	86.56	120.00	1	1
A	161	LYS	CB-CG-CD	21.40	160.51	111.30	1	1
E	20	DC	O5'-C5'-C4'	21.14	79.09	110.80	1	1
A	203	ASP	CA-CB-CG	20.86	91.74	112.60	1	1
E	21	DC	O4'-C1'-N1	20.75	139.53	108.40	1	1
A	159	VAL	CA-CB-CG1	20.53	145.30	110.40	1	1
D	19	GLU	CA-C-O	19.47	87.69	120.80	1	1
E	10	DC	O3'-P-O5'	19.39	74.91	104.00	1	1
B	128	LYS	O-C-N	19.37	92.00	123.00	1	1
D	100	PHE	CD1-CG-CD2	19.26	89.72	118.60	1	1
A	2	VAL	C-N-CA	18.93	155.77	121.70	1	1
E	24	DC	C5'-C4'-O4'	18.69	137.43	109.40	1	1
B	207	ASN	C-CA-CB	18.42	75.10	110.10	1	1
E	2	DC	P-O5'-C5'	18.41	147.62	120.00	1	1
B	136	ARG	C-CA-CB	18.19	75.54	110.10	1	1
B	134	ALA	C-N-CA	17.81	153.75	121.70	1	1
B	130	SER	C-CA-CB	17.72	76.42	110.10	1	1
A	1	LYS	C-N-CA	17.37	152.97	121.70	1	1
A	179	TRP	NE1-CE2-CZ2	17.24	155.96	130.10	1	1
E	20	DC	N1-C6-C5	17.02	95.47	121.00	1	1
F	5	DT	O5'-C5'-C4'	16.94	136.20	110.80	1	1
E	12	DC	C5'-C4'-O4'	16.52	134.18	109.40	1	1
E	20	DC	C4'-C3'-O3'	16.47	134.70	110.00	1	1
D	172	HIS	CB-CG-CD2	16.39	109.90	131.20	1	1
A	179	TRP	CD2-CE2-NE1	16.33	86.17	107.40	1	1
A	1	LYS	CA-C-N	16.28	148.76	116.20	1	1

Chain	Res	Type	Atoms	|Z|	Observed (Å)	Ideal (Å)	Model ID (Worst)	Models (Total)
F	1	DT	O3'-P-O5'	16.21	79.69	104.00	1	1
D	100	PHE	CD1-CE1-CZ	15.94	91.31	120.00	1	1
E	19	DC	C5'-C4'-O4'	15.86	85.62	109.40	1	1
E	24	DC	O4'-C1'-C2'	15.77	82.74	106.40	1	1
D	19	GLU	CA-CB-CG	15.52	145.15	114.10	1	1
A	3	VAL	O-C-N	15.48	147.77	123.00	1	1
D	100	PHE	CB-CG-CD1	15.10	146.38	120.70	1	1
E	21	DC	C1'-N1-C6	15.01	97.18	119.70	1	1
D	98	MET	CA-C-O	14.99	95.31	120.80	1	1
D	98	MET	O-C-N	14.86	146.77	123.00	1	1
F	3	DT	P-O5'-C5'	14.71	142.07	120.00	1	1
D	19	GLU	C-CA-CB	14.71	82.15	110.10	1	1
E	23	DC	C3'-O3'-P	14.70	142.25	120.20	1	1
E	13	DC	N1-C6-C5	14.60	99.10	121.00	1	1
E	12	DC	O4'-C1'-C2'	14.60	84.50	106.40	1	1
B	136	ARG	N-CA-CB	14.50	135.15	110.50	1	1
A	2	VAL	O-C-N	14.13	100.40	123.00	1	1
A	179	TRP	CD1-NE1-CE2	14.09	134.25	108.90	1	1
E	33	DC	P-O5'-C5'	14.04	141.06	120.00	1	1
D	20	LEU	CA-C-N	14.01	137.91	116.90	1	1
D	97	VAL	C-N-CA	13.97	146.84	121.70	1	1
D	22	ALA	N-CA-CB	13.91	131.26	110.40	1	1
E	23	DC	OP1-P-OP2	13.86	161.58	120.00	1	1
E	20	DC	O4'-C4'-C3'	13.82	84.67	105.40	1	1
A	161	LYS	CA-CB-CG	13.78	141.66	114.10	1	1
D	18	ALA	C-CA-CB	13.73	131.10	110.50	1	1
B	133	SER	C-N-CA	13.56	146.11	121.70	1	1
E	24	DC	O4'-C4'-C3'	13.51	85.14	105.40	1	1
A	2	VAL	CA-C-N	13.50	143.20	116.20	1	1
E	13	DC	C1'-N1-C6	13.49	99.46	119.70	1	1
D	143	GLU	CB-CG-CD	13.47	135.50	112.60	1	1
D	172	HIS	CB-CG-ND1	13.07	142.30	122.70	1	1
E	13	DC	O3'-P-O5'	13.02	123.53	104.00	1	1
E	12	DC	C1'-N1-C6	12.92	139.08	119.70	1	1
B	137	ALA	C-CA-CB	12.82	91.27	110.50	1	1
E	13	DC	C1'-N1-C2	12.79	138.88	119.70	1	1
B	129	ASN	C-N-CA	12.77	144.69	121.70	1	1
E	12	DC	O4'-C1'-N1	12.73	127.49	108.40	1	1
F	9	DG	P-O5'-C5'	12.61	138.91	120.00	1	1
E	33	DC	C3'-O3'-P	12.48	138.92	120.20	1	1
E	2	DC	C3'-O3'-P	12.42	138.84	120.20	1	1
B	206	SER	C-N-CA	12.42	99.35	121.70	1	1

Chain	Res	Type	Atoms	|Z|	Observed (Å)	Ideal (Å)	Model ID (Worst)	Models (Total)
E	19	DC	O4'-C4'-C3'	12.36	86.86	105.40	1	1
E	29	DC	C4'-C3'-O3'	12.33	128.49	110.00	1	1
D	19	GLU	CA-C-N	12.31	140.83	116.20	1	1
E	13	DC	C2'-C1'-N1	12.29	95.06	113.50	1	1
B	132	PRO	N-CA-C	12.25	142.72	112.10	1	1
B	131	GLN	CA-C-N	12.23	135.25	116.90	1	1
E	13	DC	N3-C4-N4	12.15	136.12	117.90	1	1
E	24	DC	C3'-C2'-C1'	12.14	119.81	101.60	1	1
E	21	DC	C3'-O3'-P	12.09	138.34	120.20	1	1
B	130	SER	N-CA-CB	12.00	130.89	110.50	1	1
E	10	DC	O3'-P-OP2	11.96	143.88	108.00	1	1
E	13	DC	C4'-C3'-O3'	11.90	127.85	110.00	1	1
B	207	ASN	O-C-N	11.82	141.92	123.00	1	1
D	22	ALA	C-CA-CB	11.80	92.81	110.50	1	1
D	21	PRO	N-CA-C	11.74	141.44	112.10	1	1
E	13	DC	O4'-C1'-N1	11.66	125.89	108.40	1	1
A	34	ARG	NE-CZ-NH1	11.51	109.99	121.50	1	1
E	19	DC	C4'-C3'-O3'	11.27	126.90	110.00	1	1

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	30.10	195

There are 195 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)
D:20:LEU:CD2	D:20:LEU:CG	1.63	1	1
D:180:LEU:HD21	E:11:DC:C5'	1.59	1	1
B:134:ALA:C	B:134:ALA:CA	1.58	1	1
D:180:LEU:CD2	E:11:DC:H5'	1.57	1	1
B:134:ALA:CA	B:134:ALA:N	1.56	1	1
B:129:ASN:CA	B:129:ASN:N	1.54	1	1
D:20:LEU:CA	D:20:LEU:CB	1.54	1	1
B:129:ASN:C	B:129:ASN:CA	1.54	1	1
B:130:SER:C	B:130:SER:CA	1.54	1	1
E:12:DC:C1'	E:12:DC:N1	1.53	1	1
B:133:SER:C	B:133:SER:CA	1.52	1	1
B:207:ASN:CA	B:207:ASN:CB	1.50	1	1
B:130:SER:CA	B:130:SER:N	1.48	1	1
D:20:LEU:C	D:20:LEU:CA	1.46	1	1
D:20:LEU:CA	D:20:LEU:N	1.45	1	1

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
D:98:MET:C	D:99:GLU:N	1.44	1	1
B:207:ASN:HB2	B:208:GLU:N	1.43	1	1
B:207:ASN:C	B:208:GLU:N	1.35	1	1
B:130:SER:C	B:130:SER:CB	1.29	1	1
B:207:ASN:CB	B:208:GLU:N	1.22	1	1
B:207:ASN:C	B:207:ASN:CB	1.22	1	1
F:1:DT:C2'	F:2:DT:H71	1.21	1	1
B:133:SER:C	B:133:SER:HA	1.13	1	1
B:130:SER:HB3	B:130:SER:O	1.13	1	1
D:180:LEU:HD21	E:11:DC:H5"	1.13	1	1
D:180:LEU:CD2	E:11:DC:C5'	1.12	1	1
B:130:SER:HA	B:130:SER:N	1.12	1	1
B:134:ALA:HA	B:134:ALA:N	1.10	1	1
D:131:ASP:OD2	E:13:DC:N4	1.09	1	1
F:1:DT:H2"	F:2:DT:C7	1.08	1	1
F:1:DT:H2"	F:2:DT:H71	1.08	1	1
D:180:LEU:HD23	E:11:DC:H5'	1.05	1	1
E:22:DC:C2	E:22:DC:C4	1.04	1	1
B:130:SER:C	B:130:SER:HB3	1.01	1	1
D:138:LEU:O	E:12:DC:OP1	0.99	1	1
D:131:ASP:CG	E:13:DC:N4	0.98	1	1
D:20:LEU:CD2	D:20:LEU:HG	0.96	1	1
B:129:ASN:HA	B:129:ASN:N	0.96	1	1
F:1:DT:C2'	F:2:DT:C7	0.92	1	1
D:150:LEU:HD11	D:186:ILE:HG23	0.88	1	1
B:172:ILE:HD13	B:181:LEU:HD23	0.88	1	1
E:12:DC:H1'	E:12:DC:N1	0.87	1	1
B:205:LEU:HA	B:208:GLU:HG2	0.85	1	1
D:98:MET:C	D:99:GLU:CA	0.85	1	1
F:1:DT:O3'	F:2:DT:H5"	0.85	1	1
D:131:ASP:OD1	E:13:DC:N4	0.84	1	1
D:131:ASP:OD2	E:13:DC:C4	0.83	1	1
F:1:DT:H2'	F:2:DT:H71	0.81	1	1
D:137:LYS:HD3	D:183:LYS:HD2	0.81	1	1
D:104:ILE:HA	D:112:PHE:HA	0.81	1	1
F:1:DT:H2"	F:2:DT:C5	0.80	1	1
B:207:ASN:C	B:207:ASN:HB2	0.79	1	1
B:165:GLN:HA	B:168:VAL:HG22	0.78	1	1
B:207:ASN:HB2	B:208:GLU:CA	0.76	1	1
F:1:DT:O3'	F:2:DT:C5'	0.75	1	1
B:134:ALA:C	B:134:ALA:CB	0.75	1	1
E:12:DC:C1'	E:12:DC:C2	0.74	1	1

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
F:4:DT:O3'	F:5:DT:O5'	0.73	1	1
D:178:MET:HE3	D:180:LEU:HD11	0.73	1	1
D:140:THR:H	D:143:GLU:HB2	0.73	1	1
B:130:SER:CB	B:130:SER:O	0.73	1	1
B:207:ASN:C	B:208:GLU:CA	0.72	1	1
F:1:DT:H2"	F:2:DT:C6	0.72	1	1
B:169:LEU:HD21	B:225:ALA:HB3	0.71	1	1
B:134:ALA:C	B:134:ALA:HA	0.69	1	1
D:20:LEU:CA	D:20:LEU:H	0.69	1	1
B:207:ASN:CA	B:207:ASN:CG	0.68	1	1
B:177:ARG:HH21	B:181:LEU:HA	0.67	1	1
B:130:SER:C	B:130:SER:OG	0.64	1	1
B:169:LEU:HD13	B:205:LEU:HD13	0.64	1	1
B:156:MET:HG2	B:158:ALA:HB2	0.62	1	1
D:154:ASP:HA	D:161:PRO:HG2	0.62	1	1
F:7:DT:H1'	F:8:DT:H5'	0.62	1	1
D:137:LYS:HB3	D:183:LYS:HG3	0.62	1	1
D:180:LEU:CD2	E:11:DC:C4'	0.61	1	1
D:227:ARG:HG2	D:239:THR:HA	0.60	1	1
B:207:ASN:CB	B:207:ASN:N	0.60	1	1
B:156:MET:CG	B:158:ALA:HB2	0.60	1	1
D:133:ASP:OD1	E:14:DC:N4	0.59	1	1
B:134:ALA:H	B:134:ALA:HA	0.59	1	1
D:178:MET:HE3	D:180:LEU:HD21	0.59	1	1
D:150:LEU:HD21	D:190:SER:HB3	0.59	1	1
B:131:GLN:HB3	B:132:PRO:HD3	0.58	1	1
F:2:DT:H2"	F:3:DT:H71	0.57	1	1
D:161:PRO:HB2	D:162:LEU:HD23	0.56	1	1
D:217:LYS:HD3	E:2:DC:H4'	0.56	1	1
D:160:PRO:HB2	D:161:PRO:HD3	0.56	1	1
F:1:DT:C2'	F:2:DT:C5	0.56	1	1
B:170:ASN:ND2	B:173:LYS:HE3	0.55	1	1
D:102:TYR:HD2	D:104:ILE:HG13	0.55	1	1
B:161:LEU:HB2	B:166:ASN:HD21	0.54	1	1
B:212:TYR:CD1	D:38:LEU:HD22	0.54	1	1
D:48:TYR:CE2	D:50:ALA:HB2	0.54	1	1
D:180:LEU:HD21	E:11:DC:H5'	0.54	1	1
D:113:MET:SD	D:124:PRO:HA	0.53	1	1
B:207:ASN:CA	B:208:GLU:N	0.53	1	1
D:103:VAL:HG12	D:113:MET:HB3	0.53	1	1
B:193:MET:CB	B:198:ILE:HD11	0.52	1	1
B:136:ARG:CG	B:137:ALA:H	0.52	1	1

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
B:168:VAL:HG12	B:190:LEU:HD12	0.51	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	1006	872	97	37

There are 37 unique backbone outliers. Detailed list of outliers are tabulated below.

Chain	Res	Type	Models (Total)
A	2	VAL	1
A	4	PRO	1
A	10	PRO	1
A	32	ASN	1
A	47	GLU	1
A	150	ILE	1
A	153	ARG	1
A	154	SER	1
A	156	ASN	1
A	203	ASP	1
A	224	PRO	1
A	231	GLY	1
B	79	PRO	1
B	129	ASN	1
B	131	GLN	1
B	133	SER	1
B	134	ALA	1
B	135	GLY	1
B	136	ARG	1
B	139	ILE	1
B	141	ASN	1
B	156	MET	1
B	157	PRO	1
B	194	SER	1
B	224	ASP	1
D	17	PRO	1
D	20	LEU	1
D	21	PRO	1
D	22	ALA	1
D	27	SER	1
D	84	GLU	1
D	90	VAL	1
D	91	VAL	1
D	94	PRO	1

Chain	Res	Type	Models (Total)
D	96	PRO	1
D	98	MET	1
D	159	GLU	1

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	882	790	31	61

There are 61 unique sidechain outliers. Detailed list of outliers are tabulated below.

Chain	Res	Type	Models (Total)
A	3	VAL	1
A	4	PRO	1
A	10	PRO	1
A	65	PRO	1
A	82	ILE	1
A	85	LYS	1
A	106	PRO	1
A	114	PRO	1
A	153	ARG	1
A	159	VAL	1
A	161	LYS	1
A	192	PRO	1
A	221	PRO	1
A	224	PRO	1
A	273	GLN	1
A	277	PRO	1
A	292	GLU	1
A	300	PRO	1
A	306	LYS	1
A	324	GLU	1
A	326	PRO	1
A	414	PRO	1
A	422	ARG	1
B	5	PRO	1
B	44	PRO	1
B	58	PRO	1
B	78	PRO	1
B	79	PRO	1
B	88	HIS	1
B	105	PRO	1
B	121	ASN	1

Chain	Res	Type	Models (Total)
B	130	SER	1
B	132	PRO	1
B	138	PRO	1
B	139	ILE	1
B	142	PRO	1
B	176	PRO	1
B	178	PRO	1
B	197	SER	1
B	211	ILE	1
C	6	PRO	1
C	22	PRO	1
C	56	PRO	1
C	61	ILE	1
C	64	ILE	1
C	91	PRO	1
C	108	PRO	1
C	112	PRO	1
D	9	PRO	1
D	17	PRO	1
D	20	LEU	1
D	21	PRO	1
D	47	PRO	1
D	63	LYS	1
D	66	PRO	1
D	94	PRO	1
D	96	PRO	1
D	124	PRO	1
D	170	PRO	1
D	172	HIS	1
D	178	MET	1

5. Fit to Data Used for Modeling Assessment

SAS data used in this integrative model could not be validated as the sasCIF file is currently unavailable or incomplete.

6. Fit to Data Used for Validation Assessment

Validation for this section is under development.

Acknowledgments

The development of integrative model validation metrics, implementation of a model validation pipeline, and creation of a validation report for integrative structures are funded by NSF awards to the PDB-IHM team (DBI-1756248, DBI-2112966, DBI-2112967, DBI-2112968, and DBI-1756250) and awards from NSF, NIH, and DOE to the RCSB PDB (DBI-2321666, R01GM157729, and DE-SC0019749). The PDB-IHM team and members of the Sali lab contributed model validation metrics and software packages.

Dr. Jill Trewhella, Dr. Dina Schneidman, and members of the SASBDB repository are acknowledged for their advice and support in implementing SAS validation methods. Team members from the labs of Dr. Juri Rappsilber, Dr. Alexander Leitner, Dr. Andrea Graziadei, and members of PRIDE database are acknowledged for their advice and support in implementing crosslinking-MS validation methods. We are grateful to Dr. Shruthi Viswanath for discussions about uncertainty assessment of integrative structural models.

Members of the wwPDB Integrative/Hybrid Methods Task Force provided recommendations and community support for the project.