

# Integrative Structure Validation Report

September 10, 2024 - 10:35 PM PDT

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

*Python-IHM Version 1.3*

*MolProbity Version 4.5.2*

*Integrative Modeling Validation Version 1.2*

PDB ID	9A4Y
PDB-Dev ID	PDBDEV_00000255
Structure Title	Integrative model of RPOA-RPOB by crosslinking MS and deep learning
Structure Authors	Kolja Stahl; Oliver Brock; Juri Rappsilber

*This is a PDB-Dev IM Structure Validation Report for a publicly released PDB-Dev entry.*

*We welcome your comments at [pdb-dev@mail.wwpdb.org](mailto:pdb-dev@mail.wwpdb.org)*

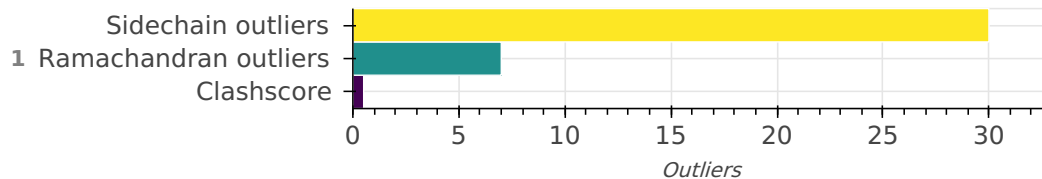
*A user guide is available at [https://pdb-dev.wwpdb.org/validation\\_help.html](https://pdb-dev.wwpdb.org/validation_help.html) with specific help available everywhere you see the  symbol.*

*List of references used to build this report is available [here](#).*

## Overall quality

*This validation report contains model quality assessments for all structures, data quality assessment for SAS datasets and fit to model assessments for SAS 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



## Ensemble information ?

This entry consists of 0 distinct ensemble(s).

## Summary ?

This entry consists of 1 unique models, with 2 subunits in each model. A total of 1 datasets or restraints were used to build this entry. Each model is represented by 0 rigid bodies and 2 flexible or non-rigid units.

## Entry composition ?

There is 1 unique type of models in this entry. This model is titled None/None.

Model ID	Subunit number	Subunit ID	Subunit name	Chain ID	Chain ID [auth]	Total residues
1	1	1	RPOA_BACSU	A	A	314
1	2	2	RPOB_BACSU	B	B	1193

## Datasets used for modeling ?

There is 1 unique dataset used to build the models in this entry.

ID	Dataset type	Database name	Data access code
1	Crosslinking-MS data	PRIDE	PXD035508

## Representation ?

This entry has only one representation and includes 0 rigid bodies and 2 flexible units.

Chain ID	Rigid bodies	Non-rigid segments

Chain ID	Rigid bodies	Non-rigid segments
A	-	1-314
B	-	1-1193

## 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	AlphaLink2	AlphaLink2	None	1	False	False

*There is 1 software package reported in this entry.*

ID	Software name	Software version	Software classification	Software location
1	<a href="#">AlphaLink2</a>	1.0	model building	<a href="https://github.com/Rappsilber-Laboratory/AlphaLink2">https://github.com/Rappsilber-Laboratory/AlphaLink2</a>

## Data quality ?

### Crosslinking-MS

Validation for this section is under development.

## Model quality ?

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

### Standard geometry: bond outliers ?

*There are 11799 bond outliers in this entry. A summary is provided below, and a detailed list of outliers can be found [here](#).*

Bond type	Observed distance (Å)	Ideal distance (Å)	Number of outliers
CA--HA	1.09	0.97	1383

<b>Bond type</b>	<b>Observed distance (Å)</b>	<b>Ideal distance (Å)</b>	<b>Number of outliers</b>
CD--HD3	1.09	0.97	246
CB--HB3	1.09	0.97	1069
CG1--HG12	1.09	0.97	233
OG1--HG1	0.96	0.84	81
CB--HB2	1.09	0.97	1069
CG--HG2	1.09	0.97	475
CE--HE3	1.09	0.97	119
CD1--HD12	1.09	0.97	238
CD2--HD21	1.09	0.97	133
CG--HG3	1.09	0.97	475
CD1--HD11	1.09	0.97	238
CE--HE2	1.09	0.97	119
CG2--HG23	1.09	0.97	314
CG2--HG21	1.09	0.97	314
CG2--HG22	1.09	0.97	314
CG1--HG13	1.09	0.97	233
CD--HD2	1.09	0.97	246
NZ--HZ3	1.01	0.89	83
OH--HH	0.96	0.84	48
CD1--HD13	1.09	0.97	238
CG1--HG11	1.09	0.97	128
CD2--HD22	1.09	0.97	133
CA--HA3	1.09	0.97	124

<b>Bond type</b>	<b>Observed distance (Å)</b>	<b>Ideal distance (Å)</b>	<b>Number of outliers</b>
NZ--HZ2	1.01	0.89	83
CD2--HD23	1.09	0.97	133
CG--HG	1.09	0.97	133
CA--HA2	1.09	0.97	124
CB--HB	1.09	0.97	314
CE--HE1	1.09	0.97	36
CB--HB1	1.09	0.97	84
NZ--HZ1	1.01	0.89	83
OG--HG	0.96	0.84	79
N--H1	1.01	0.89	2
N--H2	1.01	0.89	2
N--H3	1.01	0.89	2
SG--HG	1.33	1.20	1
SG--HG	1.34	1.20	4
N--H	1.01	0.86	1441
NH1--HH11	1.01	0.86	99
ND1--HD1	1.01	0.86	20
NH2--HH22	1.01	0.86	99
CE1--HE1	1.08	0.93	112
CD1--HD1	1.08	0.93	96
CD2--HD2	1.08	0.93	112
CZ--HZ	1.08	0.93	41
NH1--HH12	1.01	0.86	99
NH2--HH21	1.01	0.86	99

Bond type	Observed distance (Å)	Ideal distance (Å)	Number of outliers
ND2--HD22	1.01	0.86	62
NE--HE	1.01	0.86	99
NE2--HE21	1.01	0.86	49
NE2--HE22	1.01	0.86	49
CE3--HE3	1.08	0.93	7
CZ2--HZ2	1.08	0.93	7
CE2--HE2	1.08	0.93	89
ND2--HD21	1.01	0.86	62
CZ3--HZ3	1.08	0.93	7
NE1--HE1	1.01	0.86	7
CH2--HH2	1.08	0.93	7
NE2--HE2	1.01	0.86	3

### Standard geometry: angle outliers

There are 59 angle outliers in this entry. A summary is provided below, and a detailed list of outliers can be found [here](#).

Angle type	Observed angle (°)	Ideal angle (°)	Number of outliers
C-N-C-N-C-N-CA-CB-CG	112.60	118.73	1
CA-CB-N-CA-N-CA-C-N-CA-CB-CG	112.60	117.95	1
CA-CB-CG	112.60	117.73	1
N-CA-CA-CB-CG	112.60	117.62	1
CA-CB-CG	112.60	117.60	1
OE1-CD-NE2	122.60	117.62	1
CA-CB-CG	112.60	117.54	1
CA-CB-CG	112.60	117.50	1

<b>Angle type</b>	<b>Observed angle (°)</b>	<b>Ideal angle (°)</b>	<b>Number of outliers</b>
NE-CZ-NH2	119.20	123.61	1
OE1-CD-NE2	122.60	117.70	2
OE1-CD-NE2	122.60	117.71	1
CA-CB-CG	112.60	117.44	1
CB-CG-CD2	131.20	124.92	1
CA-C-OE1-CD-NE2	122.60	117.84	1
OE1-CD-NE2	122.60	117.87	1
CA-CB-CG	112.60	117.29	1
N-CA-OD1-CG-ND2	122.60	117.99	1
CA-CB-CG	112.60	117.19	1
OE1-CD-NE2	122.60	118.06	1
NE-CZ-NH2	119.20	115.12	1
CB-CG-CD2	131.20	125.34	1
OE1-CD-NE2	122.60	118.14	1
CA-CB-CG	112.60	117.05	1
CA-CB-CG	112.60	117.04	1
CA-CB-CG	112.60	117.03	1
OD1-CG-ND2	122.60	118.18	1
OE1-CD-NE2	122.60	118.21	1
CB-CG-CD2	131.20	125.51	1
CA-CB-O-C-OE1-CD-NE2	122.60	118.23	1
OE1-CD-NE2	122.60	118.23	1
OE1-CD-NE2	122.60	118.24	1
OE1-CD-NE2	122.60	118.25	2

<b>Angle type</b>	<b>Observed angle (°)</b>	<b>Ideal angle (°)</b>	<b>Number of outliers</b>
O-C-CB-CG-CD2	131.20	125.56	1
OE1-CD-NE2	122.60	118.28	1
CB-CG-CD2	131.20	125.64	1
OE1-CD-NE2	122.60	118.34	1
CB-CG-CD	112.60	119.75	1
OE1-CD-NE2	122.60	118.43	1
CB-CG-OD1-CG-ND2	122.60	118.44	1
CA-CB-CG	112.60	108.45	1
OE1-CD-CA-CB-CG	112.60	116.73	1
OE1-CD-NE2	122.60	118.48	2
CB-CG-CD2	131.20	125.85	1
OD1-CG-ND2	122.60	118.50	1
N-CA-CA-CB-CG	112.60	116.68	1
OE1-CD-OE1-CD-NE2	122.60	118.54	1
OE1-CD-NE2	122.60	118.55	1
C-N-OE1-CD-NE2	122.60	118.58	1
CA-C-CA-CB-CG	113.80	117.81	1
HZ1-NZ-HZ3	96.53	109.00	1
N-CA-HA	96.98	110.00	1
C-N-H	111.12	124.30	1
C-N-H	111.09	124.30	1
C-N-H	110.62	124.30	1
HH21-NH2-HH22	106.14	120.00	1



Angle type	Observed angle (°)	Ideal angle (°)	Number of outliers
C-N-H	108.67	124.30	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 the models in this entry.

Model ID	Clash score	Number of clashes
1	0.51	12

All 12 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Model ID	Atom-1	Atom-2	Clash overlap (Å)
1	B:90:ALA:HB2	B:118:ILE:HD11	0.704
1	B:791:HIS:CE1	B:781:LEU:HD12	0.551
1	B:777:MET:HG3	B:48:MET:HE2	0.441
1	B:48:MET:HA	B:954:ASP:HB3	0.441
1	B:781:LEU:HD11	B:910:ARG:HH22	0.437
1	B:85:ASP:CG	B:776:ILE:HD11	0.434
1	B:769:TYR:HB2	B:48:MET:HA	0.415
1	B:48:MET:CE	B:483:LYS:HE2	0.406

### 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	1503	1465	31	7

Detailed list of outliers are tabulated below.

### Torsion angles: Protein sidechains?

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

Model ID	Analysed	Favored	Allowed	Outliers
----------	----------	---------	---------	----------

<b>Model ID</b>	<b>Analyzed</b>	<b>Favored</b>	<b>Allowed</b>	<b>Outliers</b>
1	1299	1233	36	30

*Detailed list of outliers are tabulated below.*

<b>Model ID</b>	<b>Chain</b>	<b>Residue ID</b>	<b>Residue type</b>
1	A	76	THR
1	A	113	THR
1	A	124	ASP
1	A	196	LEU
1	A	283	GLU
1	A	291	LEU
1	B	2	THR
1	B	23	VAL
1	B	48	MET
1	B	59	THR
1	B	175	ASP
1	B	192	VAL
1	B	223	LYS
1	B	255	LEU
1	B	319	LEU
1	B	334	ASN
1	B	353	THR
1	B	570	ASP
1	B	753	LEU
1	B	802	THR

Model ID	Chain	Residue ID	Residue type
1	B	846	VAL
1	B	881	HIS
1	B	920	SER
1	B	1044	VAL
1	B	1048	LEU
1	B	1169	LEU
1	B	1177	PRO
1	B	1185	VAL
1	B	1189	VAL
1	B	1191	THR

### Fit of model to data used for modeling ?

#### Crosslinking-MS

Validation for this section is under development.

### Fit of model to data used for validation ?

Validation for this section is under development.

#### *Acknowledgements*

*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 ABI awards (DBI-1756248, DBI-2112966, DBI-2112967, DBI-2112968, and DBI-1756250). The PDB-Dev team and members of Sali lab contributed model validation metrics and software packages.*

*Implementation of validation methods for SAS data and SAS-based models are funded by RCSB PDB (grant number DBI-1832184). Dr. Stephen Burley, Dr. John Westbrook, and Dr. Jasmine Young from RCSB PDB, Dr. Jill Trehwella, Dr. Dina Schneidman, and members of the SASBDB repository are*

*acknowledged for their advice and support in implementing SAS validation methods.*

*Members of the [wwPDB Integrative/Hybrid Methods Task Force](#) provided recommendations and community support for the project.*