

Integrative Structure Validation Report

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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	9A0U
PDB-Dev ID	PDBDEV_00000066
Structure Title	Docking model of HLA class I with HLA class II
Structure Authors	Armony G; Heck AJR; Wu W

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

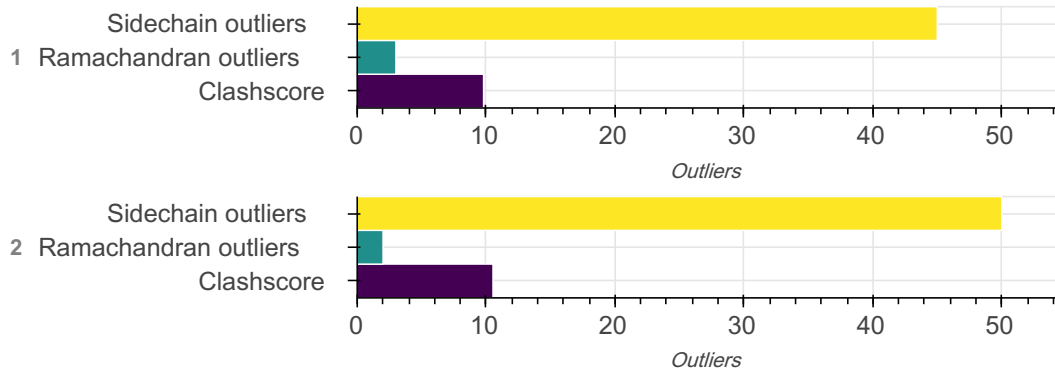
A user guide is available at https://pdb-dev.wwpdb.org/validation_help.html with specific help available everywhere you see the  symbol.

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 2 unique models, with 8 subunits in each model. A total of 5 datasets or restraints were used to build this entry. Each model is represented by 8 rigid bodies and 0 flexible or non-rigid units.

Entry composition ?

There are 2 unique types of models in this entry. These models are titled State 1/State 1, State 2/State 2 respectively.

Model ID	Subunit number	Subunit ID	Subunit name	Chain ID	Chain ID [auth]	Total residues
1	1	1	CLASS I HISTOCOMPATIBILITY ANTIGEN (HLA-A*0201) (ALPHA CHAIN)	A	A	275
1	2	2	BETA 2-MICROGLOBULIN	B	B	100
1	3	3	INFLUENZA A MATRIX PROTEIN M1 (RESIDUES 58-66)	C	C	9
1	4	4	GLY residue	D	D	1
1	5	4	GLY residue	H	H	1
1	6	5	HLA class II histocompatibility antigen, DR alpha chain	E	E	179

Model ID	Subunit number	Subunit ID	Subunit name	Chain ID	Chain ID [auth]	Total residues
1	7	6	HLA class II histocompatibility antigen, DRB1-4 beta chain	F	F	193
1	8	7	Alpha-enolase	G	G	14
2	1	1	CLASS I HISTOCOMPATIBILITY ANTIGEN (HLA-A*0201) (ALPHA CHAIN)	A	A	275
2	2	2	BETA 2-MICROGLOBULIN	B	B	100
2	3	3	INFLUENZA A MATRIX PROTEIN M1 (RESIDUES 58-66)	C	C	9
2	4	4	GLY residue	D	D	1
2	5	4	GLY residue	H	H	1
2	6	5	HLA class II histocompatibility antigen, DR alpha chain	E	E	179
2	7	6	HLA class II histocompatibility antigen, DRB1-4 beta chain	F	F	193
2	8	7	Alpha-enolase	G	G	14

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	Experimental model	PDB	1HHI
2	Experimental model	PDB	5NI9
3	Crosslinking-MS data	PRIDE	PXD022675
4	Other	Not available	Not available
5	Other	Not available	Not available

Representation ?

This entry has only one representation and includes 8 rigid bodies and 0 flexible units

Chain ID	Rigid bodies	Non-rigid segments
A	1-275	-
B	1-100	-
C	1-9	-
D	1-1:None	-
E	1-179	-
F	1-193	-
G	1-14	-
H	1-1:None	-

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	Rigid-body minimization in HADDOCK (it0)	Rigid-body minimization	None	1000	True	False
2	1	Semi-flexible SA in HADDOCK (it1)	Simulated annealing	None	200	True	False
3	1	Water refinement in HADDOCK (itw)	Refinement	None	200	True	False

There is 1 software package reported in this entry.

ID	Software name	Software version	Software classification	Software location
1	Haddock	2.2	docking	https://alcazar.science.uu.nl/services/HADDOCK2.2/

Data quality

Crosslinking-MS

Validation for this section is under development.

Model quality

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

Standard geometry: bond outliers

There are 2434 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
N--H	0.97	0.86	8
ND2--HD21	0.97	0.86	1
ND2--HD22	0.98	0.86	37
ND2--HD21	0.98	0.86	36
N--H	0.98	0.86	1133
NE2--HE22	0.98	0.86	56
NE2--HE21	0.98	0.86	50
OG--HG	0.96	0.84	33
OH--HH	0.96	0.84	37
NE1--HE1	0.98	0.86	34
ND1--HD1	0.98	0.86	18

Bond type	Observed distance (Å)	Ideal distance (Å)	Number of outliers
NE2--HE2	0.98	0.86	13
NE--HE	0.98	0.86	26
OG1--HG1	0.96	0.84	57
N--H	0.99	0.86	132
ND1--HD1	0.99	0.86	12
NE--HE	0.99	0.86	39
OH--HH	0.97	0.84	18
OG1--HG1	0.97	0.84	36
NE1--HE1	0.99	0.86	4
OG--HG	0.97	0.84	35
ND2--HD22	0.99	0.86	7
NE2--HE2	0.99	0.86	13
NE2--HE21	0.99	0.86	5
ND2--HD21	0.99	0.86	5
NE2--HE22	0.99	0.86	2
OG1--HG1	0.98	0.84	11
ND2--HD21	1.00	0.86	2
NE1--HE1	1.00	0.86	2
NE--HE	1.00	0.86	19
N--H	1.00	0.86	1
NE2--HE21	1.00	0.86	3
ND1--HD1	1.00	0.86	8
OH--HH	0.98	0.84	7

Bond type	Observed distance (Å)	Ideal distance (Å)	Number of outliers
OG--HG	0.98	0.84	2
NE2--HE2	1.00	0.86	4
NZ--HZ2	1.03	0.89	1
NZ--HZ3	1.03	0.89	2
NZ--HZ1	1.04	0.89	54
NZ--HZ3	1.04	0.89	48
NZ--HZ2	1.04	0.89	50
NZ--HZ1	1.05	0.89	10
NZ--HZ3	1.05	0.89	12
NZ--HZ2	1.05	0.89	13
NZ--HZ3	1.06	0.89	2
NH1--HH11	1.03	0.86	1
NH2--HH22	1.03	0.86	2
NH1--HH12	1.03	0.86	1
NH2--HH21	1.04	0.86	53
NH1--HH12	1.04	0.86	64
NH2--HH22	1.04	0.86	47
NH1--HH11	1.04	0.86	60
NH1--HH12	1.05	0.86	10
NH2--HH22	1.05	0.86	17
NH2--HH21	1.05	0.86	15
NH1--HH11	1.05	0.86	18
NH1--HH12	1.06	0.86	9

Bond type	Observed distance (Å)	Ideal distance (Å)	Number of outliers
NH2--HH22	1.06	0.86	18
NH1--HH11	1.06	0.86	5
NH2--HH21	1.06	0.86	16

Standard geometry: angle outliers ?

Bond angle outliers do not exist or can not be evaluated for this model

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	9.80	121
2	10.53	130

All 251 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	F:66:PRO:HB3	F:91:PHE:HB3	0.880
1	A:183:SER:HA	A:216:THR:HB	0.741
1	B:18:GLU:HB3	B:65:ASN:HB3	0.705
1	A:190:THR:HB	A:238:GLN:HB2	0.654
1	E:46:MET:HE1	F:22:LEU:HB3	0.647
1	F:56:GLU:HG2	F:60:VAL:HB	0.639
1	A:183:SER:HA	A:216:THR:CB	0.606
1	B:78:ASP:HB3	B:81:MET:HB2	0.604
1	A:82:ASP:OD2	A:84:ARG:HD3	0.602
1	B:11:GLY:HA2	B:43:SER:HB2	0.597
1	F:96:ILE:HB	F:146:HIS:HD2	0.597

Model ID	Atom-1	Atom-2	Clash overlap (Å)
1	E:3:GLU:HB2	E:111:LEU:HD22	0.585
1	A:161:PRO:HB3	A:184:PHE:HB3	0.582
1	E:78:LEU:HG	E:126:PHE:CE1	0.582
1	A:225:VAL:HG11	A:230:GLU:HA	0.579
1	A:211:PRO:HG2	B:47:LEU:HD22	0.575
1	E:43:LEU:HB2	F:129:MET:HG3	0.555
1	F:85:VAL:HG22	F:129:MET:HA	0.542
1	F:84:LEU:O	E:150:HIS:HE1	0.533
1	E:133:VAL:HB	F:49:ARG:HD2	0.533
1	F:45:ASP:OD1	E:150:HIS:CE1	0.532
1	E:133:VAL:HB	F:49:ARG:HB2	0.524
1	F:45:ASP:HA	F:145:GLU:HB2	0.520
1	F:97:GLU:HB2	A:193:TRP:CZ2	0.516
1	A:179:CYS:HB2	F:25:PRO:HD3	0.512
1	F:24:ARG:HB3	A:29:GLU:OE1	0.510
1	A:26:PRO:HA	A:16:ALA:HB2	0.509
1	A:13:ASP:HB3	F:20:THR:OG1	0.506
1	F:6:TYR:HA	F:146:HIS:CD2	0.494
1	F:96:ILE:HB	A:148:LEU:HG	0.489
1	A:144:LEU:O	B:49:TYR:HA	0.489
1	B:5:LEU:O	F:40:LYS:HG2	0.489
1	F:36:LEU:O	F:38:GLU:HG2	0.487
1	F:34:LYS:O	A:40:THR:HG21	0.486

Model ID	Atom-1	Atom-2	Clash overlap (Å)
1	A:20:ARG:HG2	B:42:TRP:CE2	0.484
1	A:93:ALA:HB2	E:146:PRO:HB3	0.484
1	E:139:GLU:HG2	F:54:VAL:HG23	0.484
1	F:50:HIS:O	A:40:THR:HG23	0.482
1	A:20:ARG:HA	E:85:PHE:HB3	0.481
1	E:60:PRO:HB3	E:113:ARG:HD2	0.481
1	E:83:ASP:OD1	G:9:GLU:HG3	0.480
1	F:36:LEU:HD11	A:237:VAL:HG21	0.475
1	A:163:THR:HG21	B:42:TRP:CH2	0.473
1	A:91:GLN:HG3	F:124:PHE:CE2	0.473
1	F:118:GLN:HG3	A:87:ARG:HB2	0.471
1	A:78:ASP:HB2	A:221:ALA:HA	0.469
1	A:205:GLU:O	B:43:SER:CB	0.465
1	B:11:GLY:HA2	A:218:GLN:HB3	0.464
1	A:182:LEU:HD23	F:144:VAL:HG13	0.461
1	F:96:ILE:HD11	A:93:ALA:HB3	0.457
1	A:72:GLN:HB2	E:138:VAL:HG21	0.457
1	E:62:VAL:HG21	A:28:ILE:HG22	0.455
1	A:25:ALA:O	B:50:THR:HG22	0.453
1	B:5:LEU:HB3	E:12:LYS:HA	0.452
1	E:8:ASP:O	C:9:LEU:HD23	0.451
1	A:123:TRP:CZ2	B:21:LEU:HD21	0.450
1	B:7:CYS:HB2	A:108:SER:OG	0.446

Model ID	Atom-1	Atom-2	Clash overlap (Å)
1	A:103:LYS:HD2	E:137:ARG:O	0.446
1	E:92:VAL:HA	F:144:VAL:HG21	0.442
1	F:68:VAL:HG21	B:47:LEU:HD11	0.436
1	B:6:ASN:HB3	F:1:TYR:HB2	0.435
1	E:46:MET:HE2	A:239:HIS:HD2	0.434
1	A:189:ILE:HB	F:122:TRP:CH2	0.434
1	F:59:THR:HG22	E:111:LEU:CD2	0.432
1	E:3:GLU:HB2	G:9:GLU:OE1	0.431
1	G:9:GLU:HA	A:180:TRP:O	0.430
1	A:163:THR:HA	F:122:TRP:HB2	0.430
1	F:121:ASP:O	A:230:GLU:HG3	0.429
1	A:225:VAL:HG11	B:76:LYS:NZ	0.428
1	B:59:GLU:OE2	F:56:GLU:HB2	0.427
1	F:52:TYR:O	A:177:LEU:HD12	0.426
1	A:177:LEU:HA	C:9:LEU:HD12	0.423
1	A:53:ASP:HB3	A:232:ARG:O	0.423
1	A:195:ARG:HA	A:142:GLU:OE1	0.421
1	A:139:THR:HA	E:48:LYS:HE2	0.421
1	E:45:ILE:HA	A:246:LEU:HB2	0.417
1	A:237:VAL:HB	E:94:TRP:CZ2	0.417
1	E:80:CYS:HB2	F:100:TRP:CZ2	0.417
1	F:86:CYS:HB2	A:217:PHE:HB2	0.416
1	A:184:PHE:CE2	A:133:ARG:HG3	0.414

Model ID	Atom-1	Atom-2	Clash overlap (Å)
1	A:106:LEU:HB3	A:222:ALA:HB3	0.414
1	A:205:GLU:OE1	E:119:ARG:HG2	0.414
1	E:111:LEU:HB2	A:248:LEU:HD11	0.412
1	A:163:THR:HB	B:54:PRO:HD2	0.411
1	B:1:LYS:O	A:185:TYR:CE1	0.409
1	A:6:ASP:HB2	A:21:MET:SD	0.408
1	A:10:VAL:HB	A:131:GLN:HG3	0.408
1	A:127:HIS:O	A:29:GLU:HG2	0.404
1	A:23:PRO:HB2	E:131:GLU:N	0.404
1	E:131:GLU:CD	E:149:LYS:HD3	0.402
1	E:149:LYS:HA	G:1:LYS:N	0.402
2	G:1:LYS:HD2	F:91:PHE:HB3	0.884
2	F:66:PRO:HB3	A:203:ASP:HB2	0.849
2	A:200:GLN:HG3	G:9:GLU:HG3	0.773
2	F:36:LEU:HD11	A:246:LEU:HB2	0.752
2	A:237:VAL:HB	E:40:LYS:HE2	0.736
2	A:104:GLU:HB2	B:65:ASN:HB3	0.725
2	B:18:GLU:HB3	A:238:GLN:HB2	0.707
2	E:43:LEU:HB2	A:87:ARG:HB2	0.694
2	A:190:THR:HB	F:22:LEU:HB3	0.651
2	A:78:ASP:HB2	F:60:VAL:HB	0.641
2	E:46:MET:HE1	B:43:SER:HB2	0.638
2	F:56:GLU:HG2	A:230:GLU:HA	0.635

Model ID	Atom-1	Atom-2	Clash overlap (Å)
2	B:11:GLY:HA2	B:81:MET:HB2	0.619
2	A:225:VAL:HG11	F:146:HIS:HD2	0.618
2	B:78:ASP:HB3	E:111:LEU:HD22	0.593
2	F:96:ILE:HB	A:249:ARG:HD3	0.574
2	E:3:GLU:HB2	B:47:LEU:HD22	0.571
2	A:231:GLN:O	B:57:LYS:H	0.553
2	A:211:PRO:HG2	A:29:GLU:OE1	0.552
2	B:55:THR:HG22	F:129:MET:HA	0.552
2	A:26:PRO:HA	A:216:THR:HB	0.549
2	F:84:LEU:O	E:137:ARG:O	0.539
2	A:183:SER:HA	F:49:ARG:HB2	0.532
2	E:92:VAL:HA	F:129:MET:HG3	0.532
2	F:45:ASP:HA	A:40:THR:HG23	0.531
2	F:85:VAL:HG22	F:145:GLU:HB2	0.526
2	A:20:ARG:HA	F:25:PRO:HD3	0.517
2	F:97:GLU:HB2	F:49:ARG:HD2	0.517
2	F:24:ARG:HB3	E:126:PHE:CE1	0.516
2	F:45:ASP:OD1	A:148:LEU:HG	0.513
2	E:78:LEU:HG	F:20:THR:OG1	0.510
2	A:144:LEU:O	F:146:HIS:CD2	0.507
2	F:6:TYR:HA	B:47:LEU:HD11	0.501
2	A:214:ASP:HB3	A:37:ASP:CG	0.500
2	F:96:ILE:HB	A:40:THR:HG21	0.495

Model ID	Atom-1	Atom-2	Clash overlap (Å)
2	B:6:ASN:HB3	B:42:TRP:CE2	0.490
2	A:20:ARG:HH22	F:54:VAL:HG23	0.489
2	A:20:ARG:HG2	F:38:GLU:HG2	0.488
2	A:93:ALA:HB2	F:40:LYS:HG2	0.486
2	F:50:HIS:O	F:1:TYR:HB2	0.484
2	F:34:LYS:O	A:84:ARG:HD3	0.483
2	F:36:LEU:O	A:29:GLU:HG2	0.481
2	E:46:MET:HE2	B:42:TRP:CH2	0.476
2	A:82:ASP:OD2	A:232:ARG:O	0.476
2	A:23:PRO:HB2	F:144:VAL:HG21	0.474
2	A:91:GLN:HG3	E:85:PHE:HB3	0.467
2	A:195:ARG:HA	A:93:ALA:HB3	0.466
2	F:68:VAL:HG21	B:50:THR:HG22	0.466
2	E:60:PRO:HB3	E:138:VAL:HG21	0.466
2	A:72:GLN:HB2	E:113:ARG:HD2	0.465
2	B:5:LEU:HB3	E:48:LYS:HE2	0.464
2	E:62:VAL:HG21	F:124:PHE:CE2	0.464
2	E:83:ASP:OD1	F:144:VAL:HG13	0.463
2	E:45:ILE:HA	G:9:GLU:OE1	0.460
2	F:118:GLN:HG3	A:247:THR:HA	0.457
2	F:96:ILE:HD11	B:43:SER:CB	0.457
2	G:9:GLU:HA	E:140:HIS:HD2	0.456
2	A:235:CYS:O	C:9:LEU:HD23	0.455

Model ID	Atom-1	Atom-2	Clash overlap (Å)
2	B:11:GLY:HA2	A:193:TRP:CZ2	0.449
2	E:89:VAL:O	A:221:ALA:HA	0.447
2	A:123:TRP:CZ2	A:142:GLU:OE1	0.444
2	A:179:CYS:HB2	G:10:LYS:NZ	0.444
2	A:212:ALA:HB1	A:21:MET:SD	0.443
2	A:205:GLU:O	A:227:SER:OG	0.443
2	A:139:THR:HA	E:111:LEU:CD2	0.442
2	G:9:GLU:OE1	B:49:TYR:HA	0.433
2	A:10:VAL:HB	F:122:TRP:CH2	0.431
2	A:173:HIS:HA	A:28:ILE:HG22	0.430
2	E:3:GLU:HB2	E:150:HIS:HE1	0.428
2	B:5:LEU:O	F:100:TRP:CZ2	0.427
2	F:59:THR:HG22	A:107:ARG:HB2	0.426
2	A:25:ALA:O	A:216:THR:HG22	0.424
2	E:133:VAL:HB	A:84:ARG:HB2	0.420
2	F:86:CYS:HB2	A:185:TYR:N	0.420
2	A:105:ASP:OD2	A:131:GLN:HG3	0.419
2	A:159:ASP:OD2	B:54:PRO:HD2	0.419
2	A:82:ASP:OD2	A:108:SER:OG	0.418
2	A:159:ASP:HB2	F:122:TRP:HB2	0.418
2	A:127:HIS:O	G:5:LYS:HB2	0.417
2	B:1:LYS:O	A:110:THR:O	0.416
2	A:103:LYS:HD2	E:73:ARG:HB2	0.415

Model ID	Atom-1	Atom-2	Clash overlap (Å)
2	F:121:ASP:O	B:21:LEU:HD21	0.414
2	E:27:PHE:CE1	E:151:TRP:HZ2	0.413
2	A:100:ILE:HA	E:94:TRP:CZ2	0.413
2	E:72:LEU:O	B:54:PRO:HD2	0.411
2	B:7:CYS:HB2	B:41:ASP:OD1	0.410
2	E:70:VAL:HG21	A:36:TRP:HA	0.409
2	E:80:CYS:HB2	A:222:ALA:HB3	0.409
2	E:116:HIS:HA	B:57:LYS:HG2	0.409
2	B:53:THR:HA	B:76:LYS:NZ	0.409
2	B:39:SER:HB2	C:2:ILE:HG12	0.405
2	A:36:TRP:CE3	E:100:PRO:HB2	0.405
2	A:205:GLU:OE1	E:31:GLY:H	0.405
2	B:55:THR:CG2	C:9:LEU:HD12	0.402
2	B:59:GLU:OE2	E:87:PRO:C	0.401

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	758	712	43	3
2	758	711	45	2

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
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Model ID	Analyzed	Favored	Allowed	Outliers
1	683	575	63	45
2	683	571	62	50

Detailed list of outliers are tabulated below.

Model ID	Chain	Residue ID	Residue type
1	A	18	SER
1	A	44	LYS
1	A	105	ASP
1	A	139	THR
1	A	153	GLU
1	A	188	GLU
1	A	190	THR
1	A	192	THR
1	A	200	GLN
1	A	227	SER
1	A	234	THR
1	B	15	SER
1	B	39	SER
1	B	55	THR
1	B	59	GLU
1	B	70	SER
1	C	8	THR
1	E	2	ASP
1	E	56	THR

Model ID	Chain	Residue ID	Residue type
1	E	65	LEU
1	E	66	THR
1	E	68	SER
1	E	103	THR
1	E	105	VAL
1	E	107	GLU
1	E	129	SER
1	E	130	THR
1	F	3	GLN
1	F	57	SER
1	F	69	THR
1	F	75	THR
1	F	81	HIS
1	F	95	SER
1	F	109	THR
1	F	136	SER
1	F	145	GLU
1	F	150	THR
1	F	151	SER
1	F	154	THR
1	F	156	GLU
2	A	11	ARG
2	A	18	SER

Model ID	Chain	Residue ID	Residue type
2	A	44	LYS
2	A	105	ASP
2	A	139	THR
2	A	153	GLU
2	A	192	THR
2	A	198	GLU
2	A	200	GLN
2	A	227	SER
2	A	234	THR
2	B	15	SER
2	B	39	SER
2	B	59	GLU
2	B	70	SER
2	E	2	ASP
2	E	44	GLU
2	E	56	THR
2	E	65	LEU
2	E	66	THR
2	E	68	SER
2	E	86	THR
2	E	102	THR
2	E	106	SER
2	E	122	HIS

Model ID	Chain	Residue ID	Residue type
2	E	130	THR
2	E	148	LEU
2	F	3	GLN
2	F	57	SER
2	F	69	THR
2	F	75	THR
2	F	81	HIS
2	F	95	SER
2	F	109	THR
2	F	136	SER
2	F	145	GLU
2	F	150	THR
2	F	151	SER
2	F	154	THR
2	F	156	GLU
2	F	161	SER
2	G	9	GLU
2	G	10	LYS

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.

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