

Supplementary Figure S1.

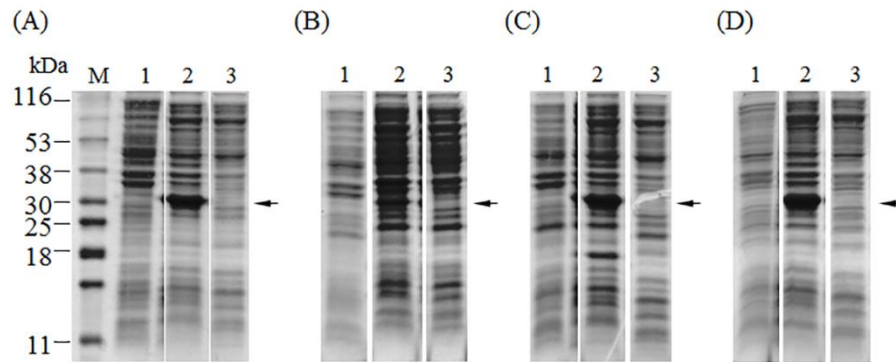
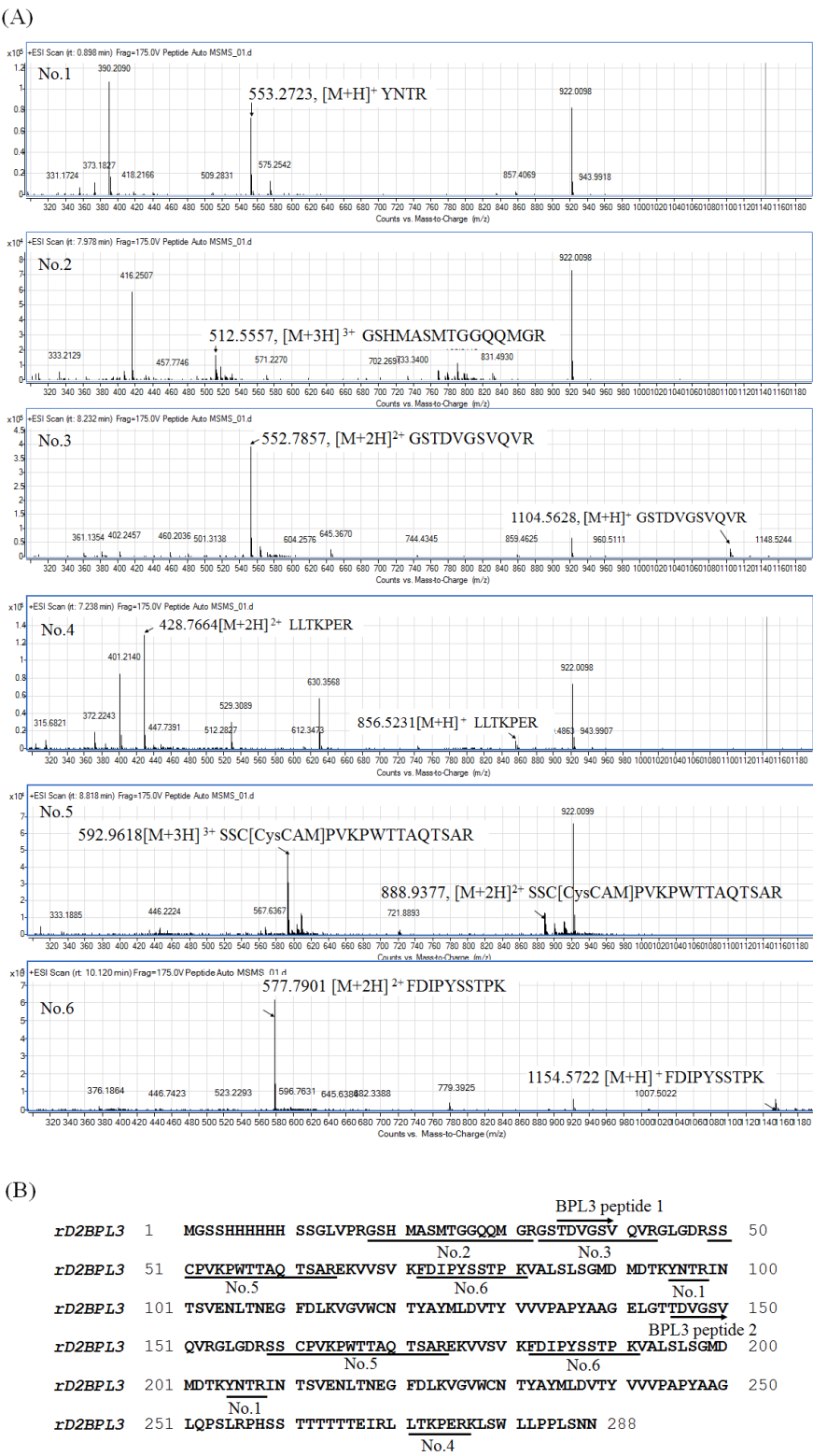


Figure S1. Expression efficiency of rD2BPL3 for various expression hosts. (A) BL21(DE3), (B) BL21(DE3)pLysS, (C) BL21-CodonPlus(DE3)-RIL, (D) Rosetta(DE3). M, Molecular weight marker; Lane 1, un-induced lysate; Lane 2, IPTG induced insoluble fraction; Lane 3, IPTG-induced soluble fraction. Arrows indicate target proteins.

10 Supplementary Figure S2.



11

12 Figure S2. Confirmation of the peptide sequence using LC-MS/MS. (A) Mass spectra of trypsin-

13 digested rD2BPL3; (B) Peptide sequence and matching with mass spectrum data.

Supplementary Figure S3.

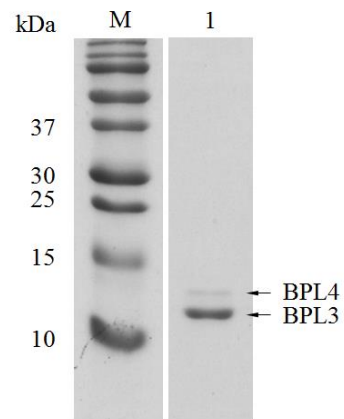


Figure S3. Purification of native BPL3. M, Molecular weight marker; Lane 1, Purified BPL3. Arrows indicate purified proteins.

Supplementary Figure S4.

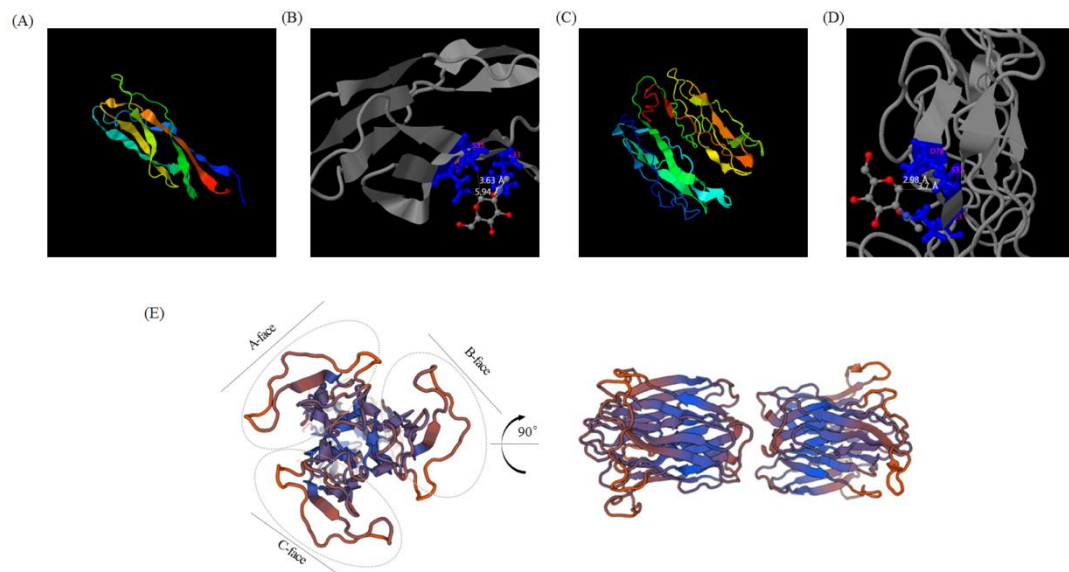


Figure S4. Predicted 3-dimensional structure of BPL3. Structures were analyzed by protein sequence similarity analysis using I-TASSER program (<https://zhanglab.ccmb.med.umich.edu/I-TASSER/>) and Swiss-Prot 3D structure prediction program (<https://swissmodel.expasy.org/>) with normal parameters; C-score was typically in the range of [-5, 2], where a C-score of a higher value signifies a model with a higher confidence and vice-versa; (A) native BPL3, c-score was 0.07; (B) enlarged image of native BPL3 binding sites; (C) rD2BPL3, c-score was -3.31; (D) enlarged image for rD2BPL3 binding sites; (E) predicted 3D structure was calculated using Swiss-Model. BPL3 was matched with Helix Pomatia agglutinin (HPA)

Table S1. Glycan array of recombinant and native BPL3. Binding signals were normalized using a program provided by RayBioTech

Substrates	Glycan Structures	RFU (Normalized)	
		rD2BPL3	Native BPL3
Positive Control	-	29,419	29,419
Neg	-	75	50
1	β -Glc-Sp	860 $\pm$ 401	148 $\pm$ 52
2	β -Gal-Sp	510 $\pm$ 675	161 $\pm$ 44
3	α -Man-Sp	1,322 $\pm$ 366	1,025 $\pm$ 57
4	α -Fuc-Sp	1,313 $\pm$ 422	205 $\pm$ 72
5	α -Rha-Sp	86 $\pm$ 17	101 $\pm$ 25
6	β -GlcNAc-Sp	3,164 $\pm$ 479	348 $\pm$ 112
7	β -GalNAc-Sp	698 $\pm$ 545	97 $\pm$ 15
8	Tobramycin	492 $\pm$ 13	121 $\pm$ 41
9	Gal- β -1,3-GlcNAc- β -Sp	1,646 $\pm$ 696	201 $\pm$ 65
10	Gal- α -1,3-Gal- β -1,3-GlcNAc- β -Sp	729 $\pm$ 306	685 $\pm$ 135
11	Neu5Ac- α -2,3-Gal- β -1,3-GlcNAc- β -Sp	165 $\pm$ 28	120 $\pm$ 55
12	Neu5Ac- α -2,6-Gal- β -1,3-GlcNAc- β -Sp	183 $\pm$ 143	298 $\pm$ 44
13	Neu5Gc- α -2,3-Gal- β -1,3-GlcNAc- β -Sp	325 $\pm$ 208	108 $\pm$ 23
14	Neu5Gc- α -2,6-Gal- β -1,3-GlcNAc- β -Sp	229 $\pm$ 199	119 $\pm$ 33
15	Gal- β -1,3-(Fuc- α -1,4)-GlcNAc- β -[Lewis A]-Sp	660 $\pm$ 290	70 $\pm$ 23
16	Gal- β -1,4-Glc- β -Sp	204 $\pm$ 198	170 $\pm$ 14
17	Gal- α -1,3-Gal- β -1,4-Glc- β -Sp	644 $\pm$ 450	119 $\pm$ 23
18	Gal- α -1,4-Gal- β -1,4-Glc- β -Sp	187 $\pm$ 106	85 $\pm$ 9
19	GlcNAc- β -1,3-Gal- β -1,4-Glc- β -Sp	786 $\pm$ 480	219 $\pm$ 84
20	GalNAc- β -1,3-Gal- β -1,4-Glc- β -Sp	87 $\pm$ 32	58 $\pm$ 19
21	Neu5Ac- α -2,3-Gal- β -1,4-Glc- β -Sp	46 $\pm$ 13	11 $\pm$ 21
22	Neu5Ac- α -2,6-Gal- β -1,4-Glc- β -Sp	57 $\pm$ 15	7 $\pm$ 32
23	Neu5Gc- α -2,3-Gal- β -1,4-Glc- β -Sp	266 $\pm$ 160	-36 $\pm$ 72
24	Neu5Ac- α -2,6-Gal- β -1,4-Glc- β -Sp	991 $\pm$ 506	178 $\pm$ 24
25	Gal- β -1,4-(Fuc- α -1,3)-Glc- β -Sp	647 $\pm$ 51	255 $\pm$ 42
26	GalNAc- β -1,3-Gal- α -1,4-Gal- β -1,4-Glc- β -Sp	132 $\pm$ 16	130 $\pm$ 10
27	GlcNAc- β -1,6-GlcNAc- β -Sp	864 $\pm$ 482	125 $\pm$ 7
28	4-P-GlcNAc- β -1,4-Man- β -Sp	148 $\pm$ 77	116 $\pm$ 23
29	Glc- α -1,2-Gal- α -1,3-Glc- α -Sp	260 $\pm$ 157	78 $\pm$ 13
30	Gal- β -1,3-GalNAc- α -Sp	64 $\pm$ 13	5,075 $\pm$ 429
31	Gal- β -1,4-GlcNAc- β -Sp	66 $\pm$ 38	105 $\pm$ 20
32	Gal- β -1,4-(Fuc- α -1,3)-GlcNAc- β -[Lewis X]-Sp	93 $\pm$ 29	104 $\pm$ 13
33	Neu5Ac- α -2,3-Gal- β -1,4-(Fuc- α -1,3)-GlcNAc- β -[Sialyl Lewis X]-Sp	235 $\pm$ 130	25 $\pm$ 7
34	Neu5Ac- α -2,3-Gal- β -1,3-(Fuc- α -1,4)-GlcNAc- β -[Sialyl Lewis A]-Sp	973 $\pm$ 183	138 $\pm$ 32
35	Neu5Gc- α -2,3-Gal- β -1,3-(Fuc- α -1,4)-GlcNAc- β -[Sialyl Lewis A]-Sp	346 $\pm$ 115	45 $\pm$ 24
36	Gal- α -1,4-Gal- β -1,3-GlcNAc- β -Sp	721 $\pm$ 328	1,082 $\pm$ 209
37	Gal- β -1,4-GlcNAc- β -1,3-Gal- β -1,4-Glc- β -[LNnT]-Sp	797 $\pm$ 255	351 $\pm$ 207
38	GlcA- β -1,4-GlcNAc- α -1,4-GlcA- β -Sp	401 $\pm$ 296	104 $\pm$ 23
39	GlcNAc- β -1,6-(Gal- β -1,3)-GalNAc- α -O-Ser-Sp4	77 $\pm$ 48	1,398 $\pm$ 148
40	Neu5Ac- α -2,3Gal- β -1,4-(6S)GlcNAc- β -Sp	326 $\pm$ 222	72 $\pm$ 13
41	GalNAc- β -1,4-GlcNAc- β -Sp2	993 $\pm$ 332	134 $\pm$ 45
42	Neu5Ac- α -2,8-Neu5Ac- α -2,3-Gal- β -1,4-Glc- β -Sp	102 $\pm$ 79	65 $\pm$ 16
43	Neu5Gc- α -2,8-Neu5Ac- α -2,3-Gal- β -1,4-Glc- β -Sp	40 $\pm$ 21	46 $\pm$ 13
44	GalNAc- α -1,3-(Fuc- α -1,2)-Gal- β -1,4-Glc- β -[Blood A antigen tetrose]-Sp1	70 $\pm$ 18	256 $\pm$ 48

45	GlcNAc- β -1,2-Man- α -Sp	1,290 $\pm$ 426	173 $\pm$ 53
46	Neu5Ac- α -2,3-Gal- β -Sp1	565 $\pm$ 90	42 $\pm$ 4
47	Gal- β -1,3-GalNAc- β -1,3-Gal- β -Sp1	53 $\pm$ 34	12 $\pm$ 29
48	Glc- α -1,2-Gal- α -Sp	264 $\pm$ 150	74 $\pm$ 28
49	Gal- β -1,4-(Fuc- α -1,3)-GlcNAc- β -1,3-Gal- β -Sp1	43 $\pm$ 39	2 $\pm$ 25
50	Neu5Ac- α -2,3-Gal- β -1,4-(Fuc- α -1,3)-Glc- β - [3-Sialyl-3-fucosyllactose/ F-SL]-Sp1	54 $\pm$ 9	2 $\pm$ 30
51	GlcNAc- β -1,4-GlcNAc- β -Sp1	135 $\pm$ 3	57 $\pm$ 34
52	β -D-GlcA-Sp	595 $\pm$ 257	99 $\pm$ 10
53	Gal- β -1,4-(6S)GlcNAc- β -Sp	169 $\pm$ 71	84 $\pm$ 16
54	GlcNAc- α -1,3-(Glc- α -1,2-Glc- α -1,2)-Gal- α -1,3-Glc- α -Sp	214 $\pm$ 90	64 $\pm$ 24
55	Gal- β -1,3-GalNAc- β -1,4-(Neu5Gc- α -2,3)-Gal- β -1,4-Glc- β -Sp1	138 $\pm$ 37	69 $\pm$ 8
56	Sisomicin Sulfate	105 $\pm$ 9	80 $\pm$ 24
57	GalNAc- α -1,3-(Fuc- α -1,2)-Gal- β -[Blood A antigen trisaccharide]-Sp1	59 $\pm$ 30	181 $\pm$ 73
58	Fuc- α -1,2-Gal- β -1,4-GlcNAc- β -[Blood H antigen trisaccharide]-Sp1	57 $\pm$ 21	72 $\pm$ 5
59	Gal- α -1,3-(Fuc- α -1,2)-Gal- β -[Blood B antigen trisaccharide]-Sp1	158 $\pm$ 92	72 $\pm$ 24
60	Fuc- α -1,2-Gal- β -1,3-GlcNAc- β -1,3-Gal- β -1,4-Glc- β -[LNFP I]-Sp1	81 $\pm$ 51	44 $\pm$ 17
61	Fuc- α -1,2-Gal- β -1,4-Glc- β -[Blood H antigen trisaccharide]-Sp1	148 $\pm$ 60	84 $\pm$ 24
62	Gal- α -1,3-(Fuc- α -1,2)-Gal- β -1,4-Glc- β -[Blood B antigen tetrasaccharide]-Sp1	108 $\pm$ 20	14 $\pm$ 7
63	(Fuc- α -1,2)-Gal- β -1,4-(Fuc- α -1,3)-GlcNAc- β - [Lewis Y]-Sp1	49 $\pm$ 28	24 $\pm$ 20
64	(Fuc- α -1,2)-Gal- β -1,3-(Fuc- α -1,4)-GlcNAc- β - [Lewis B]-Sp1	122 $\pm$ 31	60 $\pm$ 18
65	Gal- β -1,3-(Fuc- α -1,4)-GlcNAc- β -1,3-Gal- β -1,4-(Fuc- α -1,4)-Glc- β - [Lewis A]-Sp1	45 $\pm$ 10	47 $\pm$ 17
66	Gal- β -1,3-GalNAc- β -Sp1	39 $\pm$ 16	17 $\pm$ 9
67	Gal- β -1,3-(Neu5Ac- α -2,6)-GalNAc- β -Sp	318 $\pm$ 43	240 $\pm$ 32
68	Neu5Ac- α -2,6-Gal- β -1,3-GalNAc- β -Sp	247 $\pm$ 59	101 $\pm$ 124
69	Neu5Ac- α -2,6-Gal- β -1,3-(Neu5Ac- α -2,6)-GalNAc- β -Sp	421 $\pm$ 59	2,518 $\pm$ 904
70	Neu5Ac- α -2,3-Gal- β -1,3-(Neu5Ac- α -2,6)-GalNAc- β -Sp	789 $\pm$ 117	209 $\pm$ 12
71	Neu5Ac- α -2,6-(Neu5Ac- α -2,3)-Gal- β -1,3-GalNAc- β -Sp	993 $\pm$ 349	96 $\pm$ 24
72	GalNAc- β -1,4-(Neu5Ac- α -2,3)-Gal- β -1,4-Glc- β -[GM2]-Sp	191 $\pm$ 44	338 $\pm$ 96
73	GalNAc- β -1,4-(Neu5Ac- α -2,8-Neu5Ac- α -2,3)-Gal- β -1,4-Glc- β -[GD2]-Sp	131 $\pm$ 66	154 $\pm$ 22
74	Gal- α -1,4-Gal- β -1,4-GlcNAc- β -Sp1	238 $\pm$ 289	12 $\pm$ 22
75	β -D-Rha-Sp	615 $\pm$ 331	99 $\pm$ 8
76	Glc- α -1,4-Glc- β -Sp1	227 $\pm$ 59	265 $\pm$ 19
77	Glc- α -1,6-Glc- α -1,4-Glc- β -Sp1	941 $\pm$ 234	190 $\pm$ 57
78	Maltotriose- β -Sp1	796 $\pm$ 340	19 $\pm$ 18
79	Glc- α -1,6-Glc- α -1,6-Glc- β -Sp1	376 $\pm$ 148	62 $\pm$ 38
80	Maltotetraose- β -Sp1	181 $\pm$ 89	43 $\pm$ 45
81	GlcNAc- α -1,4-GlcA- β -1,4-GlcNAc- α -1,4-GlcA- β -Sp	200 $\pm$ 124	277 $\pm$ 61
82	Maltohexaose- β -Sp1	108 $\pm$ 54	47 $\pm$ 24
83	Maltoheptaose- β -Sp1	72 $\pm$ 20	90 $\pm$ 17
84	Acarbose- β -Sp1	113 $\pm$ 53	33 $\pm$ 14

85	D-Pentamannuronic acid- β -Sp1	150 $\pm$ 41	146 $\pm$ 17
86	L-Pentaguluronic acid- β -Sp1	529 $\pm$ 439	89 $\pm$ 7
87	D-Cellose- β -Sp1	1,119 $\pm$ 495	225 $\pm$ 69
88	Gal- α -1,3-Gal- β -Sp1	368 $\pm$ 176	141 $\pm$ 20
89	β -1,4-Xylotetrose-Sp1	155 $\pm$ 110	84 $\pm$ 9
90	Chitin-Trisaccharide-Sp1	45 $\pm$ 31	44 $\pm$ 28
91	KDN- α -2,8-Neu5Ac- α -2,3-Gal- β -1,4-Glc- β -Sp	108 $\pm$ 20	59 $\pm$ 16
92	Neu5Ac- α -2,8-Neu5Gc- α -2,3-Gal- β -1,4-Glc- β -Sp	177 $\pm$ 127	34 $\pm$ 15
93	Neu5Ac- α -2,8-Neu5Ac- α -2,8-Neu5Ac- α -2,3-Gal- β -1,4-Glc- β -Sp3	122 $\pm$ 53	72 $\pm$ 24
94	Neu5Ac- α -2,8-Neu5Ac- α -2,6-Gal- β -1,4-Glc-Sp5	102 $\pm$ 42	35 $\pm$ 18
95	Gal- β -1,3-GalNAc- β -1,4-(Neu5Ac- α -2,3)-Gal- β -1,4-Glc- β -Sp1	115 $\pm$ 26	88 $\pm$ 28
96	Gentamicin Sulfate	104 $\pm$ 25	76 $\pm$ 19
97	Kanamycin Sulfate	128 $\pm$ 44	102 $\pm$ 6
98	Geneticin Disulfate Salt (G418)	61 $\pm$ 19	28 $\pm$ 23
99	Neomycin Trisulfate	333 $\pm$ 36	129 $\pm$ 37
100	SGP	75 $\pm$ 6	52 $\pm$ 22

33

34