

Studies on Lectins from Marine Shells(III): Screening of Lectin-like Agglutinins from Marine Shells

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(Received October 5, 1986)

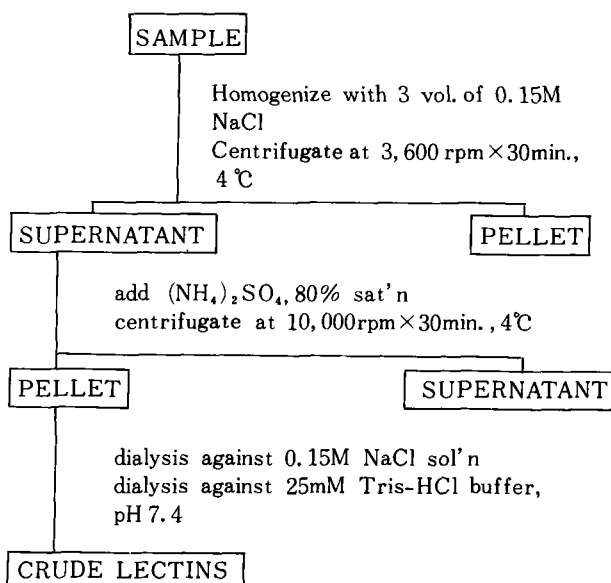
Abstract □ Forty species of marine shells were collected from Korean coasts and studied extensively for their lectin activities by using erythrocytes of human blood A, AB, B, O group and rabbit blood. In total, 7 species contained lectins: *Neptunea intersculpta*, *Omphalius nigerimus* and *Scapharca subcrenata*, blood group nonspecific; *Saxidomus purpuratus*, human blood A and AB group specific, *Lepidozona coreana*, *Tegillarca granosa* and *Neptunea polycosta*, rabbit blood specific.

Keywords □ Lectins, Screening of lectins, Lectin activities, Cell agglutination, Marine animal lectins, Functions of lectins.

Lectins are multivalent carbohydrate binding proteins that can be detected and measured by their ability to agglutinate cells. Cell agglutination is a consequence of the formation of numerous lectin bridges between surface oligosaccharide determinants on neighbouring cells. By virtue of this characteristic, lectins have become powerful tools in biochemical research, *e.g.*, 1) in studies of cell membrane structure and cell transformation, 2) a useful tools for cell separation, 3) as a diagnostic tools for a certain kind of tumor cells or cancer cells, 4) for treatment of aplastic anemia, and 5) as an antidote of nitrogen mustard, etc.

During the past decade, lectins have been found in a wide variety of plants, animals and microorganisms (1-4). However little is known about the lectins from marine animals. In 1982, Campbell (5) reported the isolation and immunological characterization of a lectin from the American lobster, *Homarus americanus*. One of the most intensively studied marine animal lectins is electrolectin. Electrolectin, a β -D-galactoside binding lectin, has been isolated from the electric organ of the electric eel, *Electrophorus electricus*, by Levi and coworker (6, 7) in recent years. Serum lectins are reported in 1983 by Vasta and

Marchalonis (8) from horseshoe crabs. Tatsumi



Scheme 1. Extraction and isolation of crude lectins.

Table 1. Blood Group Specificity of Marine Animals.

Marine Animals		Blood*					Rabbit	Common name
Family	Scientific name	Human						
		A	B	O	AB			
Acmaeidae	<i>Collisella heroldi</i>	0	0	0	0	0	True limpet	
Arcidae	<i>Scapharca broughtonii</i>	0	0	0	0	0	Ark shell	
	<i>Scapharca subcrenata</i>	32	16	32	8	32	Ark shell	
	<i>Tegillarca granosa</i>	0	0	0	0	64	Chiton	
Buccinidae	<i>Japeuthria ferrea</i>	8H	8H	8H	8H	8H		
	<i>Kelletia lischkei</i>	0	0	0	0	0	Whelk	
	<i>Neptunea arthritica cumingii</i>	0	0	0	0	0		
	<i>Neptunea intersculpta</i>	1024	1024	1024	1024	1024	Whelk	
	<i>Neptunea polycosta</i>	0	0	8	0	64	Whelk	
	<i>Voluharpa ampullacea perryi</i>	0	0	0	0	0		
Busyconidae	<i>Hemifusus ternatanus</i>	4H	4H	4H	4H	4H	False trumpet	
Chitonidae	<i>Liolophura japonica</i>	0	0	0	0	0		
Haliotidae	<i>Nordotis discus</i>	0	0	0	?	?	Abalone	
	<i>Sulculus diversicolor aquatilis</i>	0	0	0	0	0	Abalone	
Loricidae	<i>Lepidozona coreanica</i>	0	0	0	0	8		
Mactridae	<i>Mactra chinensis</i>	0	0	0	0	0	Surf clam	
Muricidae	<i>Rapana venosa (R. thomasiana)</i>	0	0	4H	4H	8H		
Mytilidae	<i>Mytilus coruscus</i>	4H	2H	4	4	?	Mussel	
	<i>Septifer (Mytilisepta) keenae</i>	8H	8H	8H	8H	0	Mussel	
Nassariidae	<i>Niotha livescens</i>	0	0	0	0	0	Dog whelk	
Novaculidae	<i>Sinnovalcula constricta</i>	0	0	0	0	0	Razor clam	
Ostreidae	<i>Crassostrea gigas</i>	0	0	0	0	0	Oyster	
Patellidae	<i>Cellana grata</i>	0	0	0	0	0		
	<i>Cellana nigrolineata</i>	0	0	0	0	0	True limpet	
	<i>Cellana toreuma</i>	0	0	0	0	0	True limpet	
Pinnidae	<i>Atrina pectinata japonica</i>	0	0	0	0	0	Pen shell	
	(<i>Servatrina pectinata</i>)							
Potamididae	<i>Batillaria multiformis</i>	8H	8H	8H	8H	0		
	<i>Cerithiopsisilla djadjariensis</i>	8H	8H	8H	8H	0		
Tonnidae	<i>Tonna luteostoma</i>	4	4	4	4	0	Tun shell	
Trochidae	<i>Chlorostoma argyrostoma</i>	0	0	0	0	0	Top shell	
	<i>turbinatum</i>							
	<i>Monodonta (Neumonodonta) neritoides</i>	0	0	0	0	0		
	<i>Omphalius nigerrimus</i>	64	64	64	128	?		
	<i>Omphalius pfeifferi carpenteri</i>	0	0	0	0	0		
	<i>Omphalius rusticus</i>	0	0	0	0	0	Top shell	
Turbinidae	<i>Batillus cornutus</i>	0	0	0	0	0	Turban shell	
	<i>Pomaulax japonicus</i>	0	0	0	0	0	Turban shell	
Veneridae	<i>Meretrix lusoria</i>	0	0	0	0	0	Venus clam	
	<i>Meretrix petachialis</i>	0	0	0	0	0	Venus clam	
	<i>Saxidomus purpuratus</i>	256	8H	16H	256	32H	Venus clam	
	<i>Tapes (Amygdala) philippinarum</i>	16H	16H	16H	8H	2H	Venus clam	

* Numbers from 0 to 1024 indicates the activity of agglutination by serial two-fold dilution method. Agglutination is defined as the reciprocal of the dilution end-point.

and others (9) reported on the purification and characterization of a lectin from the shellfish, *Saxidomus purpuratus*, in 1982. Lectin from the oyster, *Crassostrea virginica*, were investigated by Tripp (10, 11) and Acton and others (12).

Studies of the functions of lectins in plants have been reviewed by many authors (13-16). But research on animal lectins has only recently begun; consequently there are only limited reviews (17-19).

In the present paper, we wish to report a series of work on lectins screening from marine shells.

EXPERIMENTAL METHODS

Forty species of shells were collected from Korean coasts from January 1984 to January 1986, identified to species (20-22) and studied for their lectin activities by using erythrocytes of human blood A, AB, B, O group and rabbit blood as previously described (1-3). For this purpose, crude lectin was prepared as schematized in Scheme 1.

Extracts containing lectin caused blood cell agglutination resulting from the specific binding between sugars on blood cell membrane and lectin.

RESULTS

The results of screening tests are shown in Table I. In total, 7 species contained lectins: *Neptunea intersculpta*, *Omphalius nigerrimus* and *Scapharca subcrenata*, blood group nonspecific; *Saxidomus purpuratus*, human blood A and AB group specific; *Lepidozona coreana*, *Tegillarca granosa* and *Neptunea polycosta*, rabbit blood specific.

In the present work, we have concentrated our efforts on the screening of lectin constituents from marine shells. Our results point to the need for further research on the isolation, purification and characterization of biophysicochemical properties of lectins, as well as their functions in marine animals, and their applications in the studies of science and medicine.

ACKNOWLEDGEMENT

The work was supported by a grant from Korea Science and Engineering Foundation (KOSEF) and Peeres Co., 1984/85.

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