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ACID MUCOPOLYSACCHARIDES

IN THE DEMOSPONGIAE :

THEIR SIGNIFICANCE IN TAXONOMY,

AGGREGATION AND ADHESION.

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THESIS SUBMITTED TOWARDS THE DEGREE OF  
DOCTOR OF PHILOSOPHY  
AT THE UNIVERSITY OF AUCKLAND

FEBRUARY, 1975

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## ABBREVIATIONS

@	:	at
AMP	:	acid mucopolysaccharide
°C	:	centigrade
CMFSW	:	calcium and magnesium free sea water
C4S	:	chondroitin 4-sulphate
C6S	:	chondroitin 6-sulphate
DS	:	dermatan sulphate
ECS	:	extra <del>s</del> cellular space
EDTA	:	ethylenediaminetetra - acetic acid
EGTA	:	aminoethylethertetra - acetic acid
gm	:	gram
H	:	heparin
HA	:	hyaluronic acid
hr	:	hour
HS	:	heparan sulphate
mg	:	$10^{-3}$ gram
min	:	minute
ml	:	$10^{-3}$ litre
mm	:	$10^{-3}$ metre
mM	:	$10^{-3}$ mole
mOsM	:	$10^{-3}$ osmole
$\mu$	:	$10^{-6}$ metre
nm	:	$10^{-9}$ metre; 10 Angstrom units
NMP	:	neutral mucopolysaccharide
PAS	:	periodic acid-Schiff reagent
ppm	:	parts per million
RT	:	room temperature
sec	:	second
TCA	:	trichloro-acetic acid
Vol	:	volume
V/V	:	volume/volume

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## ABSTRACT

The acid-mucopolysaccharides (AMPs) found within the Demospongiae have been identified by electrophoresis, and their localization within adult tissues, aggregates and metamorphosing larvae have been examined by histological and ultrastructural techniques.

Electrophoresis of the AMPs extracted from a selection of Demospongiae showed that most of the AMPs typical of vertebrate connective tissues were present. No evidence was found in this study to suggest a possible role whereby the presence or absence of sulphated AMPs could be of use in sponge taxonomy.

Histochemical studies on the cytological localization of AMPs in both adult tissues and developing larvae also failed to provide any evidence to support the previous hypothesis that AMP localization could be used as an aid in the classification of the Demospongiae.

Ultrastructural studies on the localization of AMPs indicated several mechanisms whereby AMPs could contribute to sponge cohesion. The AMPs associated with collagen fibrils were found to be arranged in a way essentially similar to that already described for mammals, and various other lines of evidence confirm the similarity of the sponge mesohyl to vertebrate connective tissue. There is, however, no need to imply a direct evolutionary relationship.



The possible role of AMPs in both cell-cell and cell-substrate adhesion has been examined in detail. Evidence is presented for the existence of an aggregation factor in *Microciona coccinea*. The factor has been shown to be a proteoglycan in a closely related species of sponge, and although conclusive evidence on the role of factor is lacking it is interpreted by many workers to be a surface attached molecule involved in adhesion. No evidence was obtained in this study to confirm localization of the factor at the sponge cell surface, but this may be a result of limitations in present ultrastructural techniques. Initial cell contact in cell-cell adhesion during aggregation was seen to occur in the regions of narrow extensions of the plasmalemmae termed *membrane bridges*. Structures of this sort have been proposed on physical grounds as one means by which cells may overcome the electric repulsive barrier between them to make adhesion by ionic bridging. Adhesion to the substrate in metamorphosing sponge larvae was seen to be mediated by a groundmat which is believed to be secreted by the larva, and which contains a granular component as well as collagen and fine filaments.

The role of junctions in cell-cell adhesion was examined in detail in adult sponges and in aggregated cells. The presence of the cell junctions characteristic of other organisms could not be convincingly demonstrated in sponge tissues, and it seems probable that structures other than the typical cell junctions may be involved in communication and adhesion within sponges.

An unusual AMP surface coat - the larval coat - is described from the surface of the T-pinacocytes in metamorphosing larvae of *Halichondria moorei*. The similarity of this coat in some respects to the fuzzy surface coat of amoebae is noted, and some of its possible functions are discussed.

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