THE IONIC RELATIONS OF CHAETOMORPHA DARWINII (HOOKER) KUETZING

by

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This thesis contains no material which has been accepted for the award of any other degree or diploma in any University. To the best of my knowledge no material has been included which has been written or published by another person except where due reference is made in the text.

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SUMMARY

Chaetomorpha darwinii is a marine green alga with large coenocytic cells and is suitable for ion permeability experiments.

The movement of sodium and potassium ions across the cell boundaries was studied. An analysis of the rate at which isotope diffuses out of the tissue shows three distinct phases in series and this is consistent with the model suggested for the *Characean* cells. An analysis of each compartment of the cell was made and the metabolic inhibitor DNP was used to elucidate the active and passive fluxes.

Using a microelectrode technique it was found that the vacuole was -35 mV and the cytoplasm was +10 mV relative to the external solution. The coenocyte of *Chaetomorpha* thus has a significant potential difference across the tonoplast.

A range of metabolic inhibitors was used to trace the source of energy used in the ion transport. In *Chaetomorpha* energy for ion transport appears to be derived from ATP or ATP mediated reactions.

SYMBOLS USED

a	Ion activity coefficient
ATP	Adenosine tri phosphate
ADP	Adenosine di phosphate
C	Concentration of ions (m.equiv./l)
DNP	2-4 di nitro Phenol
E_m or E_j	Transmembrane potential (mV) for any ion (j) from Nernst equation
F	Faraday's constant
FS	Free space
k_1	Rate constant for exchange of ions from Cytoplasm
P_1	Permeability constant[x] of plasmalemma
R	Universal gas constant
S_0	Specific activity of the external solution (counts/min/10ml)
S_2	Specific activity of the cytoplasmic phase
S_3 or S_v	Specific activity of the vacuole
Q_s or Q_2	Amount of ion in the vacuole (m.equiv./kg)
Q_c^x	Amount of isotope in cytoplasm (counts/min/10ml)

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[x] P_1 defined as $\phi_1 = P_1 \dfrac{\ln \exp E_1 F/RT}{1 - \exp EF/RT} \cdot C_2$

where $C_2 = 600$ m.equiv./l

T	Absolute temperature ($^{\circ}$K)
t	Period in solution
$t^{\frac{1}{2}}$	Time for half exchange of isotope from a compartment
z	Charge on the ion
ϕ_1	Fluxes between free space and cytoplasmic phase (net flux = zero)
ϕ_2	Fluxes between cytoplasmic phase and vacuole (net flux = zero)