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CONVERSION OF BIOMEMBRANE-PRODUCED ENERGY INTO ELECTRIC FORM

IV. GENERAL DISCUSSION

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SUMMARY

Possible mechanisms of the energy-dependent charge-specific ion transfer through the membranes of mitochondria, submitochondrial particles and bacterial chromatophores are considered.

It is concluded that penetrating ions move in the electric field orientated across energy-producing membranes and supported by electron and hydrogen transfer or ATP hydrolysis. The following three possibilities for the generation of membrane potential are discussed:

1. Both the respiratory chain and ATPase operate as H^+ pumps thereby creating a potential difference across the membrane (Mitchell's scheme).

2. There exists a special pump driven by hydrolysis of a high-energy intermediate of oxidative phosphorylation.

3. Only the respiratory chain can directly produce the membrane potential, whereas ATP energy can be utilized for this purpose *via* reverse electron transfer.

In the first case, the function of the membrane potential should be the coupling of oxidation and phosphorylation. In the second and the third cases the membrane potential would be functioning as an 'energy buffer' and (or) as a mechanism for transport of penetrating compounds through the energy-producing membrane against concentration gradients.

The transfer of synthetic penetrating ions as a probe for membrane potential

Experimental data presented in the three previous communications[1-3] can be summarized as follows:

(1) Sonicated submitochondrial particles, intact mitochondria and chromatophores of *Rhodospirillum rubrum* are capable of the energy-dependent accumulation of synthetic ionized compounds.

(2) The mechanism of ion accumulation is operative with ionized compounds of various structure which penetrate across phospholipid membranes.

(3) It is the sign of the charge of the penetrating compound, rather than other