Expansion of Films of Myosin on Potassium Lactate

By suitable manipulation, it has been found possible to spread true monolayers of proteins on various substrates. These monolayers can be examined both in the Langmuir trough and by the method of surface potentials. In the course of an investigation on the properties of monolayers of myosin, it has been found that when this protein is spread on potassium lactate at *p*H 7, it assumes a much more expanded form than it does on potassium chloride and other neutral salts, at the same normality and *p*H. It is interesting to note that it is a hydroxy-acid which causes this expansion, as neither acetates nor propionates are effective; the extension is noted, although to a less degree, with tartrates.

Furthermore, on lactate, as the substrate increases in alkalinity, the film assumes an even more expanded form, whereas no such change is noticeable with potassium chloride. The effect seems to be specific in regard to myosin, for egg albumin shows no such difference.

In the accompanying table are given the approximate values for the area occupied by a gram of myosin on various substrates, and the phase boundary potential difference caused by the film.

*p*H	Substrate	ΔV max. (milli-volts)	Area per gram (square metres) (1) At commencement of uniformity of the monolayer	(2) At the point of maximum phase boundary potential
7	*M*/2 Potassium chloride	275	525	310
7	*M*/2 Potassium lactate	160	1450	600
10	*M*/2 Potassium lactate	160	2200	1000
4	*M*/2 Potassium lactate	170	1300	250

These facts may be interpreted as indicating a tendency of the myosin to extend in the presence of lactate ions. The role allotted to lactic acid at the present time in the physiology of muscle is admittedly a subordinate one, but it is certainly interesting to find that the lactate ion and the contractile substance have this mutual relationship. If the lactate does take any active part in the cycle of events during contraction, it might conceivably be that of facilitating an active relaxation of the fibrils during recovery.

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Molecular Orientation and the Probability of Dissociation of Molecules by Electron Impact

Hydrogen when bombarded by electrons with energy greater than 27 e.v. dissociates according to the following scheme:

$$H_2 \rightarrow H_2^+ + e \rightarrow H + H^+ + e + \text{kin. energy}^1.$$

In such a case, the dependence of the probability of the process upon the molecular orientation toward the electron beam will be shown in the angular distribution of the dissociation products, for they fly apart swiftly (at a velocity of 7–11 volts) along the line in which the molecular axis lay at the moment of excitation; strictly, however, a small deviation caused by the translational and the rotational motion must be considered. Our recent measurement of this distribution shows conclusively that the probability increases rapidly as the molecular axis approaches, from the perpendicular position, that parallel to the electron beam.

In Fig. 1*a*, hydrogen molecules stream downward from the jet *A* to be bombarded by 86-volt electrons in a horizontal broad thin beam, so that the sheath of ionisation is sufficiently widespread over the hole *B*. Positive ions the direction of which is defined by the hole and the twin slits of the shield (Fig. 1*b*) are received by a Faraday cage maintained at − 112 volts against the shield. The receiving system can be rotated around the cylinder axis. As the arrangement is of such high cylindrical symmetry, any deviation from a circle of the polar diagram of the current flowing into the Faraday cage indicates the dependence of the probability of ionisation or dissociation upon the molecular orientation.

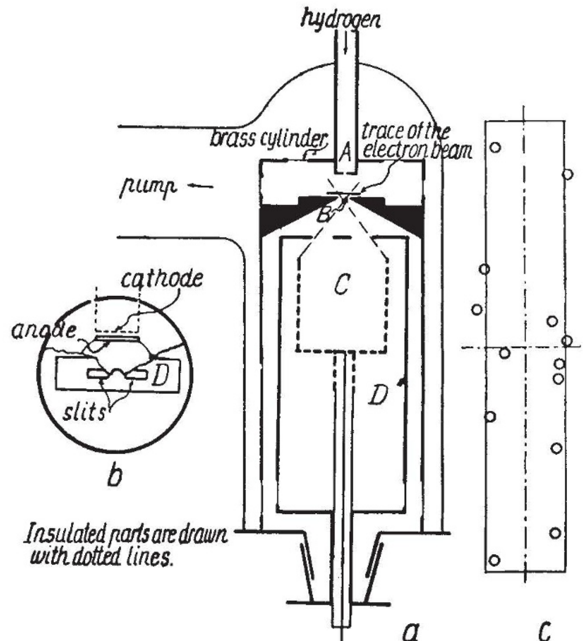

Fig. 1.

Fig. 1*c* shows the actual diagram obtained, its longer side being parallel to the electron beam. The electrostatic field due to the electron beam and ions[2] and the possible ionisation inside the shield by the scattered electrons with unequal angular distribution[3] are contrary or insufficient to produce the distortion of the diagram observed. Actually, an almost perfect circle was obtained with mercury vapour which filled the ionisation chamber uniformly. Molecular ions simultaneously formed will hit the part between the two slits of the shield. Another type of ionisation: $H_2 \rightarrow 2H^+ + 2e$, is much less frequent[1].

A similar investigation of the dissociation process through the state is in progress.

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