inhibits active chloride transport in tissues such as the gastric mucosa[8] and the relationship between these two effects is far from clear. Neither are the effects of ouabain and acetazolamide completely specific for single transport processes, an overlap occurs similar to that seen in kidney tubular absorption where ouabain or removal of HCO_3^- both cause almost complete inhibition of Na^+ reabsorption[9]. Both transport ATPase and carbonic anhydrase appear essential for optimal transport to occur, but the exact nature of the interdependence between the two remains obscure[10].

Résumé. Des blastokystes ont été pris à des lapins 6 jours après l'accouplement et couvés in vitro pendant 7 h. Le transport d'eau et de chlorure de soude a été arrêté par l'ouabaine ou par refroidissement. L'acétazolamide met en équillibre les concentrations de bicarbonate-chlorure. Il nous semble donc que c'est le transport de l'ATPase qui extrait le chlorure de soude et que l'anhydrase carbonique y concourt maintenant une concentration elevée de bicarbonate à l'intérieur du blastokyste.

M. W. SMITH

A.R.C. Institute of Animal Physiology, Babraham, Cambridge (England), 26 January 1970.

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Induced Changes of Action Potential on Cardiac Contraction

According to current views[1-3], the action potential of mammalian ventricle initiates contraction (a) by causing Ca ions to enter the cell through the surface membrane and (b) by liberating calcium from intracellular stores. In the present experiments it has been shown that the level of membrane potential during the first third of an action potential determines the rate of tension development and sets the 'time to peak'. The present results are complementary to those previously reported by MORAD and TRAUTWEIN[1].

Methods. Sheep or calf right ventricular trabeculae were placed in a 3-compartment chamber as described by WOOD et al.[3]. The middle chamber was perfused with sucrose solution and the other 2 with Tyrode. Current was made to flow between the 2 ends of the bundle which were in contact with Tyrode solution. Tension and intracellular potential were recorded from a length of less than 1 mm. The driving rate was 24/min.

Results. At a temperature of 32 °C the action potential lasted for about 400 msec (Figure 1). Pulses of 50 msec decreased the rate of tension development (dP/dt) when the amplitude of the action potential was increased (Figure 1, A) and had the opposite effect when the amplitude of the action potential was decreased (Figure 1, B). These effects on tension were largest when the pulses were applied early during activity. After about 150 msec following the onset of the action potential, the pulses had no effect on either dP/dt or on the time to peak.

Pulses of several hundred msec, which increased the amplitude and the duration of the action potential (Figure 2), resulted in a decrease of the initial twitch; tension was partially maintained throughout the interval of membrane depolarization and upon switching off the d.c. pulse, concomitant with membrane repolarization,

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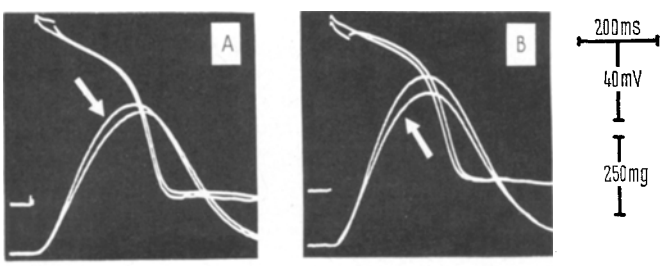

Fig. 1. Superimposed action potentials (upper records) and contractions (lower records) of a sheep ventricular bundle, 0.8 mm thick. Arrows point to the tension records as obtained under control conditions. Constant current (0.02 mA) made to flow for 50 msec, beginning 10 msec after the driving stimulus. The rate of tension development was depressed by increasing the action potential amplitude (A), and enhanced by decreasing the action potential amplitude (B).

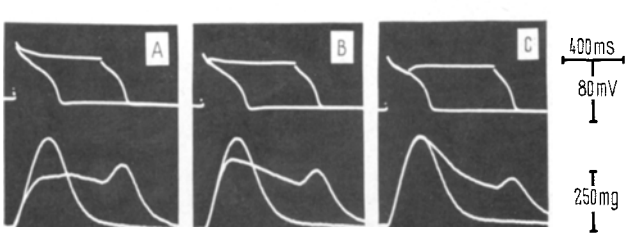

Fig. 2. Superimposed records from a calf ventricular bundle, 0.7 mm thick. A pulse of constant current (0.02 mA, 550 msec) was applied 10, 60 and 160 msec after the driving stimulus. Note the effect on the initial twitch, on maintained tension, and on the appearance of a second twitch.

there was a second rise of tension[4]. The effect on dP/dt was absent when the current was switched on later than about 150 msec after the beginning of the action potential (Figure 2, C). As in the experiments by MORAD and TRAUTWEIN[1], the period which is sensitive to voltage changes was shorter than the time to peak of the initial twitch.

Discussion. It has been demonstrated by the present results that the rate of dP/dt and the amplitude of the initial twitch depend on the membrane voltage during the early part of electrical activity.

Since it is usually assumed that the intracellular free Ca determines the contractile force, it seems reasonable to postulate that either the liberation of Ca from intracellular stores, or the transmembrane flux of Ca, is potential-sensitive. On the assumption that Ca conductance of the surface membrane increases upon depolarization[5], thus allowing Ca ions to cross the membrane down their electrochemical gradient, a decrease of inward driving force (larger amplitude of action potential) would result in a lower intracellular concentration.

An alternative way to account for the initial twitch is to make it depend entirely on the release of Ca from intracellular stores, no Ca flux through the surface membrane being involed at this stage. The mechanism by which membrane excitation releases intracellular stores is largely unknown. It seems impossible, therefore, to speculate on a possible way in which the amount of internally released Ca might depend on membrane voltage.

Zusammenfassung. Das Aktionspotential von Trabekeln aus der rechten Herzkammer von Kälbern und Schafen wird durch Gleichstrom verändert. Bei kleinerer Amplitude des Aktionspotentials wird die Kontraktion verstärkt, bei grösserer Amplitude abgeschwächt.

J. ŠUMBERA[6-8]

Department of Physiology, University of Berne, Berne (Switzerland), 15 January 1970.

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[8] Author's present address: Department of Physiology, University of Brno, Komenskeho nam. 2, Brno (CSSR).

Electrical Activity Across the Developing Rabbit Ileum in vitro

The major factor governing the magnitude and polarity of the transmural potential difference (PD) measured across the small intestine is the activity of an electrogenic sodium pump, operating in the direction lumen to plasma[1]. Sodium movement also appears to be involved in the active transport of hexoses and amino acids[2,3]. When an actively transported hexose crosses the brush border via the appropriate carrier system, it does so in the company of sodium ions, possibly on a 1:1 basis[4]. This sodium movement and the additional presentation of sodium ions to the electrogenic pump located at the lateral and basal borders of the mucosal epithelial cell probably accounts for the increase in transmural PD observed when glucose is added to the mucosal bathing medium[2]. Both this glucose transfer PD and the endogenous PD appear to increase during development in mammals[5,6]. In birds, on the other hand, both potentials decrease sharply after hatching[7].

Materials and methods. Everted sacs of rabbit distal ileum, prepared according to the method of WILSON and WISEMAN[8], were immersed in and partially filled with KREBS-HENSELEIT solution[9] at 37 °C aerated with either 95% O_2–5% CO_2 or 95% N_2–5% CO_2. The transmural PD was measured for 20 min using a high input impedence electrometer with matched calomel half cells and agar-KCl bridges. Adjacent segments of ileum were everted and randomly placed in solutions containing 0 m*M*, 2 m*M*, 5 m*M* or 10 m*M* D-glucose. The data were corrected for electrode asymmetry but not for osmotically induced potential differences.

When sucrase activity was to be measured the mucosa was scraped from the duodenum and from the remainder of the small intestine which was divided into 3 equal lengths. The procedure of CARNIE and PORTEOUS[10] was used in assaying for sucrase, with glucose being measured with a peroxidase-glucose oxidase method (Sigma Chemical Co., St. Louis, Mo., USA).

Results and discussion. Figure 1 illustrates the 5 min average transmural PD plotted as a function of medium glucose concentration. Both the endogenous PD and the glucose transfer PD increased between the second and fourth week, to reach maximum values at the sixth week. At all glucose concentrations tested the PD was lower in young adult ilea than in 6-week ilea. At all ages studied the transmural PD was significantly enhanced by the addition of glucose to the bathing medium although the magnitude of this transfer PD was significantly lower in the 1-day–2-week groups than in the 4-week-adult groups. In every age group the transmural PD-glucose dose response curve exhibited saturation.

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