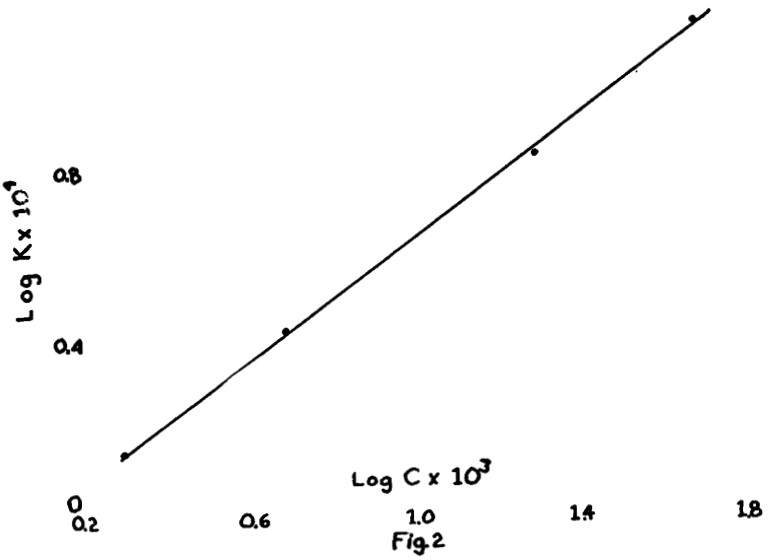

Fig. 2

in work on the effect of toxic substances."[6, 7, 8] This finding is illustrated in Figure 2, which shows a linear relation between the logarithm of the concentration of IA and the logarithm of the velocity constant.

The writers wish to acknowledge the kindness of Dr. C. B. van Niel, of the Hopkins Marine Station, who supplied pure cultures of *Streptobacterium casei* for these experiments.

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Influence of Digitalis on the Electrocardiograms of the Chick Embryo.

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Several investigators have recorded electrocardiograms on the embryonic chick, and, in the recent report of Sands,[1] a monophasic tracing was obtained at the 35th hour of incubation. A typical rapid initial ventricular phase and slow final phase, *i. e.*, Q-R-S and T deflections were not obtained until between 50 and 72 hours.

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[6] Cook, S. F., *J. Gen. Physiol.*, 1926, **9**, 575.

[7] Chick, H., *J. Hyg.*, 1908, **8**, 92.

[8] Paul, T., Birstein, G., and Reuss, A., *Biochem. Z.*, 1910, **29**, 202, 249.

[1] Sands, J., *Am. J. Physiol.*, 1929, **90**, 496.

It has been determined by Duval and others recently that ingrowth of nerve fibres does not take place until approximately the 6th day, but that the heart generally starts beating at the 10 somite stage or about 29 hours.

We attempted to obtain electrical records of the heart activity, using German silver electrode contacts along an approximate axial lead of the heart. A resistance coupled tube amplifying mechanism, the Nichols-Chase electrocardiograph apparatus, was used for amplifying and recording the action currents in most of the embryos. The Einthoven string galvanometer was occasionally employed on the older preparations.

Digitalis in an aqueous solution, as Digifoline, Ciba, equivalent to 0.1 digitalis leaf per cc. was applied directly to the exposed pulsating heart without changing the electrodes. Variations of temperature were difficult to control, but the surface was kept moist with water approximately at 37°C. Adrenalin and other drugs were applied, but the results of these applications will be reported at a later date.

The records obtained showed a multiphasic curve similar to an adult type electrocardiogram as early as the 35th hour of incubation, an embryo of 12 somites. Digitalis caused a definite change in the form and direction of the final or slow phase of the ventricular deflection. The electrical potential developed was approximately 0.5± millivolts. The occurrence of this multiphasic record, at the earliest period at which an electrocardiogram has been yet obtained, tends to support the opinion of Craib[2] and others that an initial rapid and a final slow phase is the form of electrical response demonstrated by all nerve muscle action currents.

Digitalis produced directional changes of the T waves and partial and complete auriculo-ventricular block both before and after the theoretical time of nerve fibre ingrowth. Auriculo-ventricular block was somewhat more likely to occur, however, after the 5th day.

From these findings it seems apparent that digitalis may act directly on the heart muscle and the conduction system without necessarily autonomic nervous system influence. It is recognized that some changes in form of the electrocardiograms are bound to occur with minor shifts of the heart axis, but we do not believe these shifts great enough to account for the changes which we recorded. It is an interesting observation that the "T" waves of the auricular deflection were unusually prominent in our records.

[2] Craib, W. H., The Electrocardiogram, Brit. Med. Res. Council Pub., London, 1930.