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A Technique for Recording Electrical Changes in Isolated Chick Embryo Hearts.

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It was thought that a technique of recording the electrical changes in the isolated warm blooded heart would offer possibilities of determining the direct effect of many drugs. The plan of this work is to study (a) the functional changes as recorded by the electromyograms; (b) chemical changes by subsequent analyses; (c) histopathological changes.

Towards this end the following technique was devised and has proved to work satisfactorily in preliminary experiments. Fertile chicken eggs are incubated to the desired stage. The embryos are removed from the shell and pinned out on a paraffin block. The heart is dissected out carefully, leaving a fairly long stalk of great vessels and some tissue. This avoids injury to the auricles and allows for handling. The isolated heart is then placed in a receptacle.

The receptacle used is a small glass dish cemented to an ordinary microscopic slide, which is set on a mechanical stage. The dish is filled about half way with paraffin, to allow for fixing the heart in place.

The electrodes consist of 2 zinc-zinc sulphate cells of simple construction. An ordinary test tube is drawn to a capillary about 3 inches from its mouth. The constricted portion between the capillary tip and body of the tube is bent out at about a 60° angle. The capillary tip is then bent down in the complementary angle at a point where it extends beyond the outer wall of the tube, and cut to leave a tip of a few millimeters. This is done to allow approximation of the two electrodes. A glass slide is cemented to the body of the tube with DeKhotensky for fixation to mechanical stages, by means of which motion is obtained in 3 dimensions. The capillary tip is threaded with several thicknesses of cotton string. These should be snugly packed in the capillary opening. Too tight a fit interferes with capillarity and causes poor wetting, which tends to increase the resistance. The thread should be run well up into the body of the tube. The outside string is cut about 0.5 cm. from the opening and wound with a circular thread. Sodium chloride solution (0.9%) is used to saturate the string, which serves as the immediate contact with the heart. This tube is filled with a thin paste of kaolin and

saturated zinc sulphate. The zinc poles are pushed as far down into the tube as possible. The electrodes have a resistance varying from 2000 to 4000 ohms. They can be used for constant recording over periods of several hours without showing an appreciable amount of polarization or resistance changes.

In order to maintain the hearts at proper temperature the electrodes are set up inside an incubator.

Attempts were made to use as medium Ringer's, Tyrode's, Tyrode's without glucose, Locke's, and Locke's without glucose. For reasons which will be discussed at a later date these were discarded in favor of the bare heart. Proper moisture conditions could be maintained by saturating the air of the incubator with water vapor. A shallow enamel pan of the type used in photography is placed on the bottom of the incubator. This is filled with water. An immersion "Hot Point" heater is set in the water and the cord run out through a ventilating hole in the wall of the incubator.

Alternating currents are one of the most disturbing factors encountered in the development of the technique. These can be reduced to a minimum by proper shielding. If an electric incubator is used all wires must be entirely disconnected by removing the plugs from the sockets during the time when the string galvanometer is in the circuit. The cooling of the incubator when the heating currents are off is minimized if the pan of water has been brought to a boil before disconnecting the current.

Three leads from the heart are feasible in embryos over 4 days. The attempt was made to keep them referable to the usual clinical leads. Lead α is taken across the two auricles, lead β is taken with one electrode on the right auricle and the other at the apex, γ is left auricle and apex. The records of various stages are consistent when taken at different times. Minor variations in the position of the apical electrodes in lead β and γ do not affect the fundamental picture.