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Form of the Electrocardiogram in Experimental Myocardial Infarction.

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In a series of experiments still incomplete we have attempted to determine how the changes in the initial and final deflections of the ventricular complex observed in standard and precordial[1] electrocardiograms in clinical coronary thrombosis are produced. In these experiments, performed upon fully anesthetized dogs, we have ligated the anterior descending branch of the left coronary artery or one of its major subdivisions, and have employed direct and semi-direct leads[1] as well as the usual standard leads in studying the alterations in the electrical phenomena associated with the heart beat that this procedure produces. The results of the experiments carried out thus far may be summarized as follows:

Almost immediately after the ligation of a coronary artery the electrical curves obtained by leading directly from the epicardial surface of the region supplied by it become essentially monophasic, and are similar to those obtained when the same portion of the heart's surface is injured by burning or by other means. The direction of the monophasic response is such as to indicate relative positivity of the electrode in contact with the heart (the exploring electrode) or relative negativity of the indifferent electrode, which is placed in contact with the subcutaneous tissues of the right or left hind leg. The displacement from the base line of the final portions of this monophasic curve, which correspond in time to the RS-T segment and T-deflection of the standard electrocardiogram, rapidly diminishes, but does not, apparently, completely disappear for several days.

Twenty-four to 48 hours after coronary ligation, the electrical responses obtained by leading directly from the infarcted region are quite different from those described in the preceding paragraph. They show no proper intrinsic deflection and no preliminary downward movement such as precedes that deflection in the curves obtained from other portions of the heart. They begin with a tall

[1] Wilson, F. N., Macleod, A. G., and Barker, P. S., *Am. Heart J.*, 1932, **7**, 305.

upward deflection, often notched near its apex or on its descending limb, which corresponds in time to the *QRS*-deflections in lead *I*, and indicates by its direction that the exploring electrode is relatively negative during its inscription. The *RS-T* segment which follows this initial deflection is displaced downward and the *T*-deflection is upright. During the period when curves of this type are obtained from the infarcted region, this region, at least when it is large, appears relatively immobile and does not seem to take part in ventricular contraction. Some parts of the infarcted region fail to respond to strong induction shocks; other portions respond but display a considerably prolonged absolute refractory period. At the margins of the infarcted region there appears to be a gradient in the length of the refractory period.

Serial semi-direct leads have been employed in the same manner as in an experimental study of bundle branch block recently published from this laboratory.[1] The curves obtained by this method of leading 24 to 48 hours after ligation of the anterior descending branch of the left coronary artery in the dog are similar in all respects to those obtained by means of serial precordial leads in patients who have had a recent attack of coronary thrombosis and who display standard electrocardiograms of the type attributed to infarction of the anterior surface of the left ventricle.[2] The standard leads also show strikingly similar electrocardiographic changes in dogs and in man.

Averbuck and Rachmilewitz[3] have reported that, after ligation of subdivisions of the circumflex branch of the left coronary artery in the dog, section of the right branch of the His-bundle does not produce characteristic changes of the usual kind in the electrocardiogram. In our experience section of this bundle branch after ligation of the anterior descending branch of the left coronary artery produces electrocardiographic changes that differ only slightly from those produced in normal animals by the same procedure.

These observations strongly support the view that the changes in the *QRS*-deflections of the electrocardiogram that occur in coronary thrombosis are due to the disappearance of the electrical effects normally produced by the infarcted muscle; that the displacement of the *RS-T* segment from the base line is due to the disappearance during systole of a current of injury flowing at the margins of the infarct; and that the curious *T*-wave changes that have attracted

[2] Wilson, F. N., Macleod, A. G., Barker, P. S., and Klostermeyer, L. L., PROC. SOC. EXP. BIOL. AND MED., 1932, **29**, 1006.

[3] Averbuck, S. H., and Rachmilewitz, M., *Z. f. d. ges. Exp. Med.*, 1931, **75**, 562.

so much attention are due to a prolongation of the excited state in the same region.

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Reaction Time and Chronological Age.

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Although the literature dealing with reaction time is enormous, no studies seem to have appeared of the relationship between reaction time and chronological age in a large group of individuals having a wide span of age limits. It seemed desirable that this relationship be studied.

We employed 150 individuals, sampled at random and ranging from the ages of 4 years to 60 years, grouped, for convenience, as shown in Table I.

TABLE I.

Group	Age Limits	Av. Age of Males	Av. Age of Females
	yr.	yr.	yr.
A	4-10	7.3	5.4
B	11-20	18.0	16.3
C	21-30	24.5	23.5
D	31-40	36.1	35.8
E	41-50	44.8	45.5
F	51-60	55.1	58.4

Each group contained 20 individuals, except Group F which had 10. Half the subjects in each group were females.

Our purpose being to determine the reaction times to light and sound, 2 simple arrangements were constructed. For light, an ordinary 50 watt electric light was placed in series with one of the poles of a double throw switch, the other pole being in series with a signal magnet, recording on a moving drum, the operator's key, and the subject's tap key, the response recorded by tapping the key and breaking the circuit. The apparatus for sound consisted of a signal magnet in series with the operator's and subject's tap key placed in the primary circuit of an induction coil, with a set of head telephones in the secondary circuit.

The subjects were always seated with arm and body in the same position and given the simple instructions necessary. The experimenter's operations and recording devices were not visible to the