genic state results in an altered metabolism of the avirulent cell, an alteration manifest as toxin production.

A complete report of this work will be published elsewhere.

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Technical Modifications of Radiocardiography[1]

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Radiocardiography was described in 1948 by Prinzmetal *et al.* (*1*), and its clinical applications were presented a year later (*2*). In this method, a Geiger-Mueller counter with auxiliary equipment records graphically the passing of radioactive blood through the cardiac chambers. Several disadvantages found in the application of the original method led to modifications which are reported below.

Original method (*1, 2*). A shielded Geiger-Mueller (GM) tube is placed in front of the precordium of the sitting patient, and 0.1–0.2 mc radiosodium (Na^{24}) is injected into one of the antecubital veins. The counts are graphically recorded from right to left by means of a specially constructed ink-writing device. The curve is corrected by taking the means of counts, and the reconstructed tracing consists of two main waves (*R* and *L*) representing the passage of the isotope through the right and left ventricles, respectively. The two waves are connected by a transitional plateau. The end of the second wave is usually at a much higher level than the baseline.

Disadvantages of the method. The following disadvantages were found in preliminary experiments:

a) Radioactive sodium has a short half-life (14.8 hr) and may not be available when necessary. Shipment from production centers to the laboratory is by air freight and is very expensive.

b) The poor sensitivity of the GM counter originally used required a large dose of isotope for injection.

c) The ink-writing device is not very accurate. Writing from right to left is in contrast with accepted techniques and makes the reading awkward. The actual graph consists of several irregular oscillations; the means of counts is a somewhat arbitrary and subjective procedure which lacks accuracy.

d) There is no possibility of simultaneously recording radiocardiograms and other tracings for physiological or clinical correlation.

Modifications of technique. The isotope used in our study was I^{131} in the form of diiodofluorescein;[2] a dose of 20 mc in 0.5–1 ml was injected. As the half-life of I^{131} is about one week, several clinical experiments were carried out with the material of each shipment.

The detector was a bismuth gamma GM tube[3] contained in a directional lead shield. The tube was suspended from a vertical stand, and the opening of the shield was placed about 1 in. from the center of the precordium (Erb's point) of the supine patient. The tube was connected to a count rate meter[4] and the outlet of the latter, ending in a telephone plug, was connected to a direct-writing electrocardiograph[5] with 4 channels. This permitted simultaneous recording of the radiocardiogram and of any other clinical tracing. Film speed generally used was 10 mm/sec. In some experiments, however, film speeds of 25 or 50 mm/sec were used. A signal marked the time of injection.

In our experiments, an electrocardiogram and a carotid or brachial tracing, or a respiratory tracing, were recorded with the radiocardiogram. This permitted us to ascertain the number of cardiac cycles necessary for the isotope to go through the right or the left side of the heart.

Several technical difficulties were still encountered, and some of them are not yet solved. The record of the Poly-Viso, like that of most amplifier-type galvanometers, is a plot of logarithmic intensity vs. time. There is therefore no linear proportion between the height of a deflection and the amount of isotope in the GM tube field. This tends to increase the smaller deflections and, therefore, the background effects. The use of a specially built amplifier is contemplated in future experiments.

With suitable degree of amplification, the special characteristics of the amplifier-type galvanometers automatically transform the multiple and irregular discharges of the counter into slower and more regular waves. This transformation is equivalent to, but more accurate than, the arbitrary means of discharges previously drawn over the graphs. It should be kept in mind that, following a large and slow positive deflection, the graph sometimes presents a negative deflection. This is an artifact that is due to the technical characteristics of the amplifier-type of galvanometers and should be disregarded.

[1] This study was performed under the tenure of a teaching grant of the National Heart Institute, USPHS, held by A. A. Luisada.

[2] The isotope was obtained from the Abbott Laboratories, North Chicago, Ill., on allocation from the U. S. Atomic Energy Commission.

[3] The tube was Mark 1, model 13, of Radiation Counter Laboratories.

[4] The meter was No. 1615, supplied by the Nuclear Instrument and Chemical Co., to whom we are indebted for their cooperation.

[5] The electrocardiograph used was a Sanborn Poly-Viso.

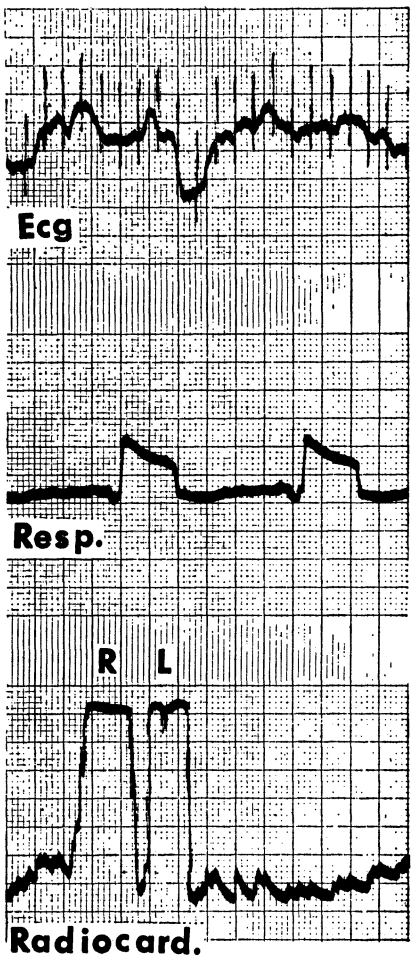

FIG. 1. Radiocardiogram of a normal dog. *R* and *L* indicate passing of the isotope through the right and left ventricles.

In a first series of experiments, 6 anesthetized dogs were studied. Later, 24 normal human subjects between 22 and 60 years of age were studied. Both in animals and in humans, the injection of the isotope is followed within 2–6 sec by a large monophasic wave lasting 1–4 sec, which may be preceded by a smaller one. Following an interval of 1–3 sec, during which the tracing may return to the baseline, a second monophasic wave occurs; this wave lasts 2.5–4 sec and is often preceded by a smaller wave (Fig. 1). It is likely that the two large monophasic waves correspond to waves *R* and *L* described by Prinzmetal and co-workers (*1, 2*) and are due to the passing of the isotope through the right and left ventricles. It is too early to decide whether the smaller waves preceding *R* and *L* are due to passing of the isotope within the respective atria. This possibility, however, should be considered. Both the *R* and the *L* wave frequently include from two to four smaller, rounded waves. In normal subjects, from two to four ventricular contractions occur during the passage of the isotope through each ventricular chamber.

Sometimes, after the end of the second large wave (*L*), more waves are visible. They frequently occur by couples which resemble the *R-L* couple originally observed. They have either the same or a greater height than the original couple and may be observed for several minutes. They might be explained by the recurrent circulation of the isotope through the right and left ventricles after returning from several possible routes. The shortest is the coronary circulation; the longest, the splanchnic circulation or that of the lower limbs. Theoretically, the mixing of the isotope with circulating blood should rapidly attenuate these waves. Therefore, the interpretation is still tentative.

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The Culture in the Developing Chicken Embryo of a Filtrable Agent from *Verruca vulgaris*

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Although there is abundant evidence (*1—7*) that the causative agent of the common wart is filtrable, there are only two reports of its having been grown in tissue other than human. Ullman (*5*) reported having produced a vaginal papilloma in a bitch which was inoculated with a human laryngeal papilloma, and Rhodes (*8*) has mentioned, without details, the successful transfer of human wart material to a monkey's prepuce. Felsher (*9*) reported failure to cultivate this agent in chick embryos.

A total of 17 warts developed on the author's right hand during a period of at least two years. The primary wart was removed by curettage and electrocautery on July 10, 1951, by a dermatologist.[2] On July 12, the wart was ground with sterile sand in a mortar until the whole was reduced to a fine powder. This was suspended in 3–4 ml of nutrient broth and frozen. Aerobic agar culture remained sterile. On July 13, the sample was thawed, resuspended, and centrifuged. One ml of the supernate was added to 10,000 u of penicillin and 10 mg of dihydrostreptomycin, each contained in 0.1 ml of .85% NaCl solution. The mixture was then inoculated on the chorioallantoic membrane (CAM) of each of 5 chick embryos 10 days old in a dose of 0.2 ml/egg by the routine technique employed in this laboratory (*10*). The original nontreated suspension was inoculated on the CAM of each of 2 other eggs in a somewhat larger dose.

[1] Paper of the Journal Series.
[2] O. J. Sokoloff, 69 Paterson St., New Brunswick, N. J.