At the end of 48 hrs the dead and live larvae were counted. During this period some of the larvae had pupated, and the live pupae were included with the surviving larvae. The results given in Table 1 indicate that

TABLE 1

COMPARATIVE TOXICITY OF LABORATORY-PREPARED DDT AND COMMERCIAL DDT TO LARVAE OF *Aëdes aegypti*

Dilution (ppm)	Per cent larvae dead in 48 hrs			
	Laboratory		Commercial	
	Total No. larvae	Dead (%)	Total No. larvae	Dead (%)
0.1	156	100	158	100
0.05	152	100	170	100
0.025	176	100	160	95
0.0125	161	85	153	75
0.010	175	62	165	50
Check (1 cc of ethanol)	160	4		

the laboratory-prepared DDT is at least as toxic to mosquito larvae as is the commercial DDT. At dilutions of 0.05 ppm both samples gave 100% dead larvae. In dilutions of 0.01 ppm the commercial sample gave 50% kill, as compared with 62% kill for the laboratory sample.

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Radiocardiography: A New Method for Studying the Blood Flow Through the Chambers of the Heart in Human Beings

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The passage of radioactive substances through the cardiac chambers can now be graphically recorded with the aid of a specially constructed, ink-writing Geiger-Müller counter. This procedure makes it possible to investigate in human beings certain hemodynamic functions not previously accessible to study. Briefly, the method consists of placing a carefully shielded Geiger-Müller tube over the precordium, rapidly injecting 0.1–0.2 mc of radiosodium (Na^{24}) into one of the antecubital veins, and recording the counts by means of the newly devised direct-writing counter.[2] The curve records the concentration of radiosodium in the structures underlying the tube, as represented by the number of disintegrations of the radioactive element per unit of time. The curve is corrected for the random bursts of radiosodium by taking the mean of the counts over a half-second period. Na^{24} has a short half-life (14.8 hrs) and is rapidly eliminated from the kidneys. The quantity injected is within the safe range recommended by the authorities, and the amount of radiation is much less than that which the patient receives during various diagnostic X-ray examinations. In the last year and a half, more than 250 subjects were given injections for radiocardiography without untoward effects.

The reconstructed precordial tracings in normal subjects generally consist of two principal waves connected by a plateau-like transitional zone. The tracings read from right to left, the injection point being at the far right. For purposes of simplicity, the first wave, which traces the blood through the chambers of the right heart, has been called the R-wave, while the second wave may be termed the L-wave, as the left heart receives and expels the labeled blood.

The initial upsweep of the curve is preceded by a level stretch at the base line. This is the period following the injection during which no radioactivity is detected over

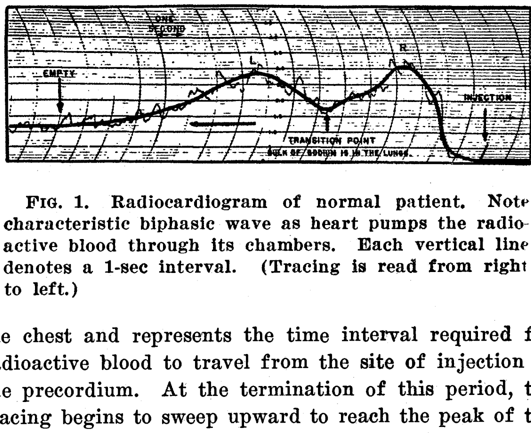

FIG. 1. Radiocardiogram of normal patient. Note characteristic biphasic wave as heart pumps the radioactive blood through its chambers. Each vertical line denotes a 1-sec interval. (Tracing is read from right to left.)

the chest and represents the time interval required for radioactive blood to travel from the site of injection to the precordium. At the termination of this period, the tracing begins to sweep upward to reach the peak of the first wave. This records the entrance of the blood into the superior vena cava, right auricle, and right ventricle. The curve then descends because of the expulsion of the labeled blood from the right heart into the lungs. The line then rises as blood returns from the pulmonary circulation and enters the chambers of the left side of the heart. After the second peak has been reached, the curve descends gradually and ends in a second plateau which lies above the base line. The long descending limb of the L-wave represents the period during which the left cardiac chambers are being emptied of the labeled blood. The end of the L-wave marks the point at which all of the injected radiosodium has completed its passage through the left ventricle. Fig. 1 shows a typical normal tracing.

In some cases the curve consists, not of two well-defined waves, but of a single large wave. The reasons why the curves are sometimes monophasic are as yet imperfectly understood and are being investigated.

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[2] We wish to thank Dr. Robert Miller, of Los Angeles, for the design and construction of the apparatus.

Precordial tracings show definite deviations in cardiac enlargement, with or without failure, and to date almost all have been monophasic. The tracings taken in subjects with enlarged hearts and failure do not appear to differ materially from those in cardiac enlargement without failure. This observation arouses interesting speculations concerning the role of the heart in failure and is being further investigated. Fig. 2 shows curves from two patients with cardiac enlargement, one of whom had clinical signs of failure.

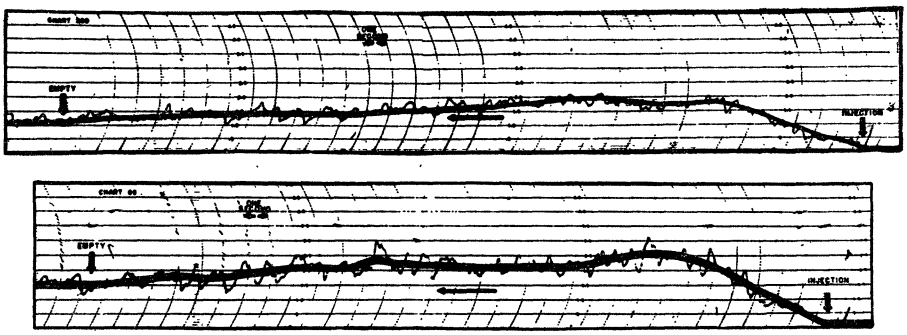

FIG. 2. Radiocardiograms of two patients with rheumatic heart disease, mitral and aortic valvulitis. The upper tracing is of a patient in profound heart failure; the lower of a clinically well patient with a large, dilated heart. Note the prolonged monophasic curves due to the fusing of the right and left waves and the long period of ejection of labeled blood from the left ventricle.

Other observations have emerged from these studies. The rate of venous return from a lower limb is much slower than that from an upper extremity. The slower rate of venous blood flow from the lower limbs, even under normal conditions, helps to explain why there is a far greater tendency for venous thrombosis to develop in the lower rather than the upper extremities.

The recording Geiger-Müller counter has also been used to estimate the time required for a substance to be absorbed from the site of local injection. For example, in one experiment, 0.01 mc of radiosodium in isotonic salt solution was injected intramuscularly and a tracing made with the tube placed over the site of injection. In this experiment the results showed that half the injected radiosodium was absorbed in 30 min and almost 90% in 1 hr. Thus, the time required for absorption was much longer than would be anticipated on the basis of commonly accepted clinical impressions. Since we have completed this phase of the experiment, it has been called to our attention that Kety (*1*) first utilized this method for the study of absorption.

In controlled experiments on hemorrhagic shock in dogs, it was found that absorption is greatly prolonged during the hypotensive phase. In one experiment, the absorption of radiosodium was 29% in ½ hr while the blood pressure was normal. The mean blood pressure was then reduced to 50 mm Hg. When the experiment was repeated on the opposite limb, it was found that in 30 min only 3% of the sodium was absorbed. After transfusion and elevation of the blood pressure, the absorption returned to normal. In view of the widespread occurrence of shock-like states requiring hypodermic medication, clinical applications of this observation are obvious.

Preliminary observations on congenital heart disease are of interest. For example, in tetralogy of Fallot, the R-wave is normal, but the L-wave is short or absent due to the shunting of blood from the right heart to the systemic circulation.

Radiocardiography has also aided in revealing certain sources of error in the usual clinical methods of determining circulation time and provides a more accurate method of determination.

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