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A Method of Graphic Registration of Heart Sounds.

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The method is an adaptation of the "ultramicrometer" described by Dowling.[1] A Hartley circuit is used. A condenser microphone and 2 "pancake" inductance coils of 85 and 100 turns each form the oscillating circuit.

Because the electrical changes to be recorded are of relatively short duration, the "zero shunt" described by Dowling is not used. A variable non-inductive resistance is placed in the plate circuit and the "ultramicrometer" is coupled to a string galvanometer through a variable, decade condenser. This does away with the necessity of compensating for the "zero" plate current of the oscillator. In addition it furnishes a means of tuning the recording circuit.

Using a very light, tightly stretched string and a rather crude condenser microphone made from an antiquated telephone transmitter, we have been able to record sounds up to 650 double vibrations per second. Harmonics up to the 6th partial of spoken sounds showing a fundamental rate of about 100 are readily recorded. With a well constructed microphone the characteristics of the ordinary galvanometer string would be the limiting factor in recording sounds of high frequency. No attempt has been made as yet to determine the limits imposed by the string that we are using.

The microphone is placed directly on the chest wall. A hole drilled in the "mouthpiece" maintains atmospheric pressure in the vibrating column of air. The main source of "noise" seems to be the vibration of the elements of the electron tube. Mechanical shielding of the tube is necessary.

The heart sound records obtained resemble those made with Ein-

[1] Dowling, J. J., *Phil. Mag.*, 1923, xlvi, 87.

thoven's "Saitenphonograph".[2] The 3rd heart sound appears in the records of all of the few subjects examined. So far we have had opportunity to obtain a record from only one case showing a heart murmur.

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Extracellular Production of Toxin by Clostridium botulinum.

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It is well known that bacterial free filtrates containing the toxin of *Clostridium botulinum* increase in toxicity when mixed with certain substances such as normal blood serum and non-specific antitoxins. The observed increases have, as a rule, been relatively small (2 to 10 fold) and the observations have been variously interpreted by the several investigators. The possibility that the toxin might be produced extracellularly by the action of the enzymes of the organism on a suitable substrate has not been seriously entertained by the more prominent workers in this field; on the contrary, the belief is generally held that the toxin is produced only intracellularly.

From our own work with *Clostridium botulinum* (Type A) we have been led to the conclusion that the toxin is produced entirely intracellularly, or nearly so, in some media, while it may be produced both intracellularly and extracellularly in certain other media.

If a bacterial free filtrate of the botulinum organism is mixed with sterile skimmed milk and the mixture incubated at 37° C. until proteolysis ensues, a material increase in toxicity takes place. This is illustrated by the example given in Table I. In this experiment 1 part of the culture filtrate was mixed with 4 parts of sterile skimmed milk and the mixture incubated at 37° C. for 4 days. As a control, some of the same filtrate was incubated alone at the same temperature for the same period of time. After incubation, series of guinea pigs were inoculated with, (1) the incubated filtrate mixed with 4 parts of sterile physiological salt solution, (2) the incubated filtrate mixed with 4 parts of sterile skimmed milk within an hour previous to inoculation, and (3) the incubated filtrate-milk mixture referred to previously.

[2] Einthoven and Hoogerwerf, *Pfluger's Archiv.*, 1924, cciv, 275.