

AN ELECTROLYTE-FREE MEDIUM FOR THE FROG HEART AND GRADED RESPONSES OF THE HEART MUSCLE

RINGER has shown that for the proper functioning of the heart, the external medium must contain suitable amounts of sodium, calcium and potassium. It is generally believed that for the contraction of all kinds of muscle, these ions are necessary. Singh (1944) has, however, shown that the frog stomach contracts spontaneously and remains irritable to electric current for about 4-6 hours in a half tonic solution of sucrose.

It has been found that the electrolyte-free medium for the frog stomach is equally good for the frog hearts used in this series of investigations. When perfused with half tonic sucrose solution, the frog heart presents the same series of phenomena as the frog stomach. At first there is a contracture followed by depression of excitability. The heart then recovers and continues to beat from half an hour to two hours; the rhythm and relaxation are, however, slow (Fig. 1). For some hearts,

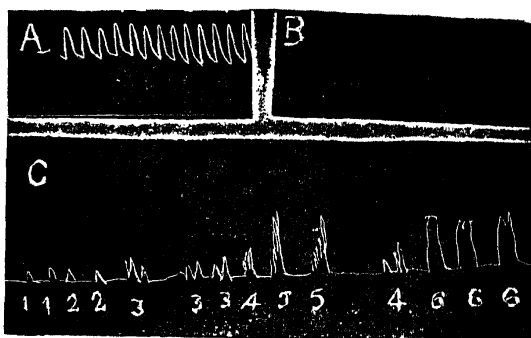


FIG. 1. A. Beating of the frog heart in Ringer. B. Beating of the same heart in isotonic solution of sucrose, after 25 minutes immersion. The heart may continue beating slowly for about two hours in the absence of electrolytes. It may remain irritable to induction shocks for another two hours.

C. Frog heart. Graded responses. Contractions No. 1 by 1.5 v for 5 sec. (D.C.).

Contraction No. 2	by 3 v D.C.
do	3 do 4.5 v D.C.
do	4 do 6.0 do
do	5 do 7.5 do
do	6 do 9 v do

In contraction Nos 1, 2 the heart has only responded to make. In contractions No. 3, 4, 5, the heart has responded by rhythmic contractions. In contraction No. 6, the heart has responded by tetanus.

an isotonic solution of sucrose was found to be better than half tonic sucrose, but if the heart had come to a standstill in the isotonic sucrose, it was revived by the half tonic sucrose solution. After the heart had stopped beating in the electrolyte-free medium, it remained irritable to induction shocks for a considerable time (one to two hours). It is thus remarkable that the heart should contract in the absence of all electrolytes; this shows that excitation in the heart muscle is produced by ions within the muscle fibres, and that the function of ions in the Ringer solution is to mutually antagonise one another.

Another remarkable phenomenon presented by these hearts was, that they behaved like plain muscle, in responding by contracture to acetylcholine and excess of potassium. As plain muscle does not obey the "All and None" law, it is to be expected that the same law would not hold good for these hearts. This was actually found to be the case. When stimulated with direct current by voltages ranging from 1.5 to 20, the responses were graded [Fig. 1 (c)]. The contraction produced by break induction shock was bigger than that produced by make shock.

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CHROMOSOME NUMBER OF *SESAMUM LACINIATUM*, KLEIN.

ONLY three species of *Sesamum* are reported in the Indian flora (Hooker). Of these, *Sesamum orientale* Linn. (= *Sesamum indicum* D.C.) is the commercial oil. Both *Sesamum prostratum* Ret. and *Sesamum laciniatum* Klein. are prostrate, perennial weeds. They closely resemble one another but for the fact of the leaves of *Sesamum laciniatum* being deeply pinnatifid. The capsules of *Sesamum laciniatum* are smaller than those of *S. prostratum*. The chromosome number of *Sesamum orientale* has already been determined to be $2n = 26$ in this laboratory (Sreenivasan, 1942). Cytogenetical work in this genus has been in progress here for some years now. Interspecific hybridisation between *Sesamum orientale* and *Sesamum prostratum* has been effected and the sterile hybrid has been made fertile by the artificial induction of amphidiploidy. Cytological and cytogenetical details connected with this work will appear elsewhere as a paper. The fertile amphidiploid is being grown through several generations and its seeds compared with those of *Sesamum orientale* in all respects, quality, quantity, oil yield, etc. It has been found that while *Sesamum orientale* is a seasonal herb, this fertile amphidiploid is perennial, flowering and fruiting throughout the year. In connection with these studies, the chromosome number of *Sesamum prostratum* ($2n = 32$, $n = 16$) both somatic and meiotic, has been determined in this laboratory (Krishnamurthy). The chromosome number of *Sesamum radiatum*, an Argentine species, was reported some years ago to be $2n = 64$ (John and Narasingha Rao). So far as we are aware, the chromosome number of the other Indian species of *Sesamum*, namely, *Sesamum laciniatum* has not been recorded. Specimens of this species were collected from several parts of India and are being grown in the University Botanical Gardens. We are carrying on hybridisation work between this