nearly touches the head of each bay and follows the east side of Kuchuk Chekmedje its entire length as it comes down nearly to sea-level to enter the city. The stream coming into the latter bay from the north apparently was a part of a cavern or subterranean system. Its roof has collapsed, but four of its tributaries are still "lost streams," two on the west emerging from caves separately, and two on the east coming out at present essentially together.

The caverns on the east were human habitations and three burial sites are known on the slopes north of the cave mouths. Much more exploration is necessary before much of the truth in this matter can be written.

Farther south and between the two embayments in at least six localities, mastodon and other animal remains are found. The places are scattered over an area more than a mile north and south and nearly a mile east and west. The eastern bay has a western thumb and four of the localities are nearly in a line north from the thumb while the other two are between the thumb and the bay itself.

The parts known are not numerous but consist of 10 pieces. One is a mastodon tooth about 7 inches, front to back, 2½ inches wide and more than 6 inches high. Three tubercles of the tooth are worn through the enamel by use, but the fourth is still rounded. A second is a patella 3 inches across and much corroded. The third is a piece of tusk somewhat flattened and presenting a cross-section of about 4 by 6 inches. The layers show very clearly and are concentric round the nerve duct. This piece is more than one foot long, nearly white and clean. The other pieces are fragments of bone, apparently legs and ribs, and may not all belong to mastodons.

The discovery of these bones is due to the activities of Dr. Fikri Servet, a Turkish physician practicing in Galata Istanbul at Rasim Pasha Han 15–17. The doctor is a fine scholarly man and desires to collect farther and explore the cave more completely. He has done some excellent work so far and has given publicity in Arabic to some parts of his findings. He was anxious that a note be printed in English and this preliminary paper is in response to his request. Dr. Servet can be reached direct at his office or through the Istanbul Y. M. C. A., of whose board he is a valued member.

GEORGE D. HUBBARD

VEGETATIVE PROPAGATION IN THE MISSOURI GOURD

SOME time ago I noticed that young plants were common around the old plants of the Missouri gourd, *Cucurbita foetidissima,* though no fruits could be found. This made me suspect that they had some vegetative method of propagation. Two methods seemed probable; by formation of buds on the roots, or by forming roots at the nodes which might survive and form new plants.

No nodal roots could be found at the time, but later in the season such roots appeared towards the ends of the numerous vines. The first root on a vine was often 10 to 12 feet from the parent root. Usually but a single root formed at a node, but sometimes two or even three were found. Several of the nodes towards the tip of the vines would form roots.

These roots soon thicken, forming successive rings of bundles somewhat as in the beet. These bundles are small, parenchyma cells filled with starch making up the bulk of the root. By fall they were about a half inch in diameter and looked something like a parsnip. Contraction of the roots tends to draw the vine into the ground at the point of attachment.

I have marked a number to see if they survive the winter, though I have no doubt that they do, as larger roots not attached to the large vines with small vines of their own are common. These were probably formed the preceding summer but may be older.

In the arid places where this plant usually grows such a method of propagation would be a great advantage, as seedlings would only be able to become established in favorable seasons. Even this method might fail in dry years.

So far I have found no mention of this method of reproduction in the literature and wonder if it has been overlooked.

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MEIOSIS IN HYPERICUM PUNCTATUM LAM.

THE cytology of the *Hypericum* species of New England and vicinity is being studied and will be reported later. It seems well, however, at this juncture to make a brief summary of meiosis in *Hypericum punctatum* Lam. The chromosome behavior in the development of pollen resembles very closely the condition reported by Cleland[1] and others for certain species of *Oenothera.* The development up to diakinesis is very similar. At no time does there appear an extended approximation of threads. Like *Oenothera* the spireme appears univalent and as Cleland remarks seems to call "for a telosynaptic interpretation." After the second contraction there emerges a chain, or chains, of chromosomes fastened end for end like sausages. There are sixteen in all. So far no complete rings or paired chromosomes have been observed as noted in *Oenothera.* Otherwise it might be mistaken for a species of the latter. During the first division the chromosomes show the same tendency to have the alternating ones pass to opposite poles.

[1] R. E. Cleland, "Meiosis in the Pollen Mother Cells of *Oenothera biennis* and *Oenothera biennis sulfurea,*" *Genetics,* 11: 127–162, 1926.

There are irregularities, however, as in *Oenothera*, and haploid plates of seven and nine, instead of the usual eight, are not uncommon. At maturity there is always a large percentage of morphologically sterile pollen. The peculiar arrangement of chromosomes seems to be of special interest and so far has been noted in no other *Hypericum*.

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SOFTENING TISSUES

IN the paper, "A Method to Soften Tissue Already Imbedded in Paraffin," which appeared in SCIENCE on December 12, 1930, it should have been stated that the work was done entirely in Dr. Linford's laboratory, and that it was at his suggestion that I tried the water soaking to soften the pineapple leaf.

A. B. COUCH

CHAPEL HILL, N. C.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

USE OF AN IMPROVED NULL INSTRUMENT FOR GLASS ELECTRODE OR OTHER HIGH RESISTANCE CIRCUITS

SEVERAL authors have described vacuum tube amplifiers for use with glass electrodes, employing radio-type vacuum tubes in circuits arranged to secure stability and sensitivity. But in even the best of these the grid current of the tube is large enough to cause polarization of the glass membrane or there are other difficulties.

A new vacuum tube has recently been described by Metcalf and Thompson.[1] This tube, the General Electric Pliotron FP 54, was especially designed for the detection of minute D.C. currents and potentials, and its use for this purpose has been discussed by Du Bridge.[2] The grid current is so small (10^{-15} amperes) that it introduces negligible errors in the measurement of potentials of systems of very high resistance. For instance, the writer has found that glass electrodes with resistance as high as 100,000 megohms may be used in the grid circuit of the tube with no difficulty. The measured potential of a standard cell in series with this value is the same as when obtained directly. When an electrode of 10,000,000 megohms was used, and allowance was made for the IR drop across it, the correct value of the standard cell was obtained within one tenth of one per cent. Using a Compton electrometer, hitherto the best instrument available, no reading at all could be made in series with this 10,000,000 megohm resistance.[3, 4]

The usefulness of this vacuum tube is obvious. It makes possible the use of thick glass membranes of small area, simplifying the drop method of MacInnes and Dole[5] by permitting the use of thicker and more rugged glass membranes. For measurements where larger quantities of liquid are available, bulb electrodes may be blown with such thick walls that they can be handled almost as roughly as test-tubes, and their resistances will be entirely negligible for this measuring instrument. The validity of the glass electrode as a hydrogen electrode is discussed in the papers by MacInnes and Dole,[5] who also give the composition of a suitable glass.

A diagram of the circuit used is given in Fig. 1. The amplifier is entirely enclosed by a heavy sheet-iron shield, and the test circuit also is carefully shielded, all shields of course being grounded. The designers of the tube recommend large storage batteries for all potentials in order to avoid drift of the

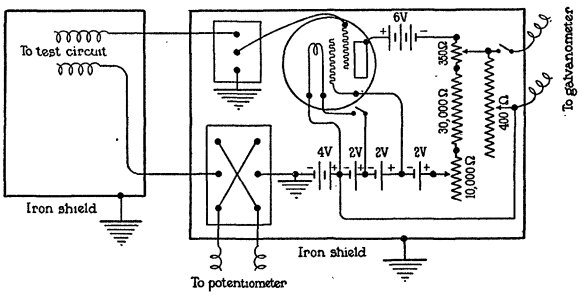

FIG. 1. Circuit for measuring D.C. potentials in high resistance circuits with the General Electric Pliotron FP 54. Batteries are lead storage cells. Resistances are wire-wound. Shielding is galvanized iron.

[1] G. F. Metcalf and B. J. Thompson, *Phys. Rev.*, 36: 1489, 1930.

[2] A. Du Bridge, *Phys. Rev.*, 37: 392, 1931.

[3] Mr. D. Belcher, of the Rockefeller Institute, kindly tried making measurements in series with these high resistances with the Compton electrometer.

[4] This vacuum tube is also a useful instrument for measuring extremely high resistances. The flow of the grid current (10^{-15} amperes) through a resistance placed in the grid circuit will cause a change in potential of the grid. From the simple equation $E = IR$, the value of the resistance may be determined. The grid current of the tube may thus be used for measuring resistance above 10^{11} ohms when the plate circuit galvanometer has a sensitivity of 0.01 micro-ampere per millimeter (permitting detection of one-tenth millivolt). Measurement of resistances below 10^{11} ohms of course calls for current from some external source, and is carried out in the usual manner.

[5] D. A. MacInnes and M. Dole, *Jour. Gen. Physiol.*, 12: 805, 1928–29. *Ind. and Eng. Chem.*, 1: 57, 1929; *Jour. Am. Chem. Soc.*, 52: 29, 1930.