galvanometer. The sensitivity of the instrument depends largely upon the galvanometer. For measuring to one tenth millivolt the writer has found adequate a galvanometer with a sensitivity of 0.01 micro ampere per millimeter. In use, the grid is grounded, and the plate resistance adjusted until the galvanometer reads zero. The grid is then connected to the circuit under test and the potentiometer adjusted until the galvanometer again reads zero. The potentiometer reading, of course, gives the E.M.F. and polarity of the test circuit.

Some of the earlier papers upon glass electrode circuits lay unnecessary emphasis upon insulation difficulties. Only ordinary care need be used except in the grid circuit of the tube. The potentiometer reversing switch is in the low resistance portion of the grid circuit and may be of almost any material and may be outside the shield with the potentiometer. In the high resistance part of the grid circuit extraordinary care must be taken that there are no insulation leaks to shunt the tube. The wire leading from the glass electrode to the grid should be shielded (a flexible copper shielded wire has been found excellent) and the single pole double throw switch for grounding or charging the grid should be the best available. The writer used a telephone "anti-capacity" switch, in which the manufacturer's black bakelite mounting was replaced by transparent bakelite, which was used also for the roller. It was found necessary to bake this transparent bakelite for two days at 115° C. in order to make its insulation good enough. Amber might, of course, be used but is more expensive. The handle of this switch was grounded in order to avoid any body charge from the operator. When glass electrodes of extremely high resistance are used, there is an initial deflection of the galvanometer on closing the switch, due to the capacity of the test circuit. The charge due to this capacity difference leaks off in a few seconds. The 400 ohm shunt resistance for the galvanometer reduces the initial deflection, and the shunt is then opened to secure full sensitivity.

The shield for the external circuit was a cage of ¼ inch mesh iron wire, which was found adequate. Inside the iron cage, the electrodes and other apparatus were held in iron clamps attached to ½ inch bakelite rods screwed into laboratory tripods. No special treatment was needed for the bakelite rods if the clamps holding the electrodes were as much as six inches apart. The bakelite rods were occasionally cleaned with alcohol and ether. In general, greater care should be taken with the insulation and shielding of the grid circuit than with an electrometer circuit, since this is a more sensitive instrument. This vacuum tube circuit is cheaper and more portable than the Compton electrometer. The Lindeman electrometer, which is portable, has the disadvantage of a low sensitivity, and must be read with a microscope. For those unaccustomed to the use of vacuum tube amplifiers, the small amount of time required to master this simple circuit will be more than compensated for by its superiority to any other method of measuring potentials in high resistance circuits.

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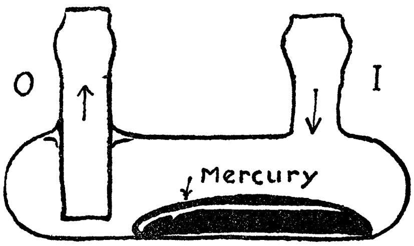
A TILTING STOPCOCK

I HAVE made and used for some time a simple stopcock which corresponds exactly to the convenient mercury switch for electric current, and which can be used in the same way for cutting positively a flow of gas under small pressure, without any danger of leak and without friction. It can be mounted like the mercury switch, that is, well balanced on a light axis, so that the slightest effort will cut off the supply of one or more Bunsen burners. I found it a great help



whenever automatic regulation of gas supply was needed. The accompanying sketch will make its construction and functioning clear. One must always connect the tubes in such a way as to have the gas enter the stopcock through inlet I. As soon as the stopcock is tilted, the mercury obstructs the outlet O, and the flow is cut off. On coming back to horizontal position, the gas resumes its flow.

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SPECIAL ARTICLES

A MOTTLED-EYED DROSOPHILA

EARLY last December a gray red-eyed female fly was found that had notched wings and an area of white facets covering the lower fourth of the left eye. The fly appeared in the F_1 generation from a cross of a treated Theta male to an untreated female having a ClB chromosome and a second X-chromosome carrying the mutant genes for yellow, white, lozenge and miniature. The single X of the Theta male had the mutant genes for yellow and scute at the left end, and a duplicated fragment attached to its extreme right end. The attached fragment is a deleted element from another X-chromosome, and has the wild-type allelomorphs for yellow, scute and broad from the left end, and the gene for bobbed (probably) from the right end. Breeding tests with this female showed that the case belonged to the so-called "eversporting" mottled type, and that mottled eyes and notched wings varied independently of each other in their phenotypic expression.

A rather extensive series of genetic tests has been carried out on this stock, but the detailed results will not be published until some later time. In this note we desire to indicate briefly some of the main points brought out in the study, and especially to suggest an explanation for the ever-sporting character of mottling and notching, as exhibited in this particular strain of flies. All the results are consistent in support of the following explanation: A piece of the left end of the treated Theta X-chromosome has been broken off and has become attached to a fourth chromosome (IV). The translocated fragment contains the mutant genes for yellow and scute and the wild-type allelomorphs for prune, white, facet echinus, and its length must therefore be greater than five and a half map units.

In the first cross made with this mottled-eyed female the Theta fragment was removed from the broken X-chromosome by a crossover. The stock has since been maintained by mating mottled-eyed females to yellow white singed males. It was found that a female zygote receiving the yellow white singed chromosome and the broken X, together with the translocated fragment, may develop into a normal yellow female (non-mottled, non-notched). But in case the fragment becomes eliminated from any cell (or cells) during morphogenesis, the descendants of this cell will produce, in combination with non-deficient cells, somatic tissue exhibiting mosaicism—mottled eyes, or notched wings, or both, depending upon whether cells that have lost the fragment happen to enter the embryonic rudiments of these structures. If the F_1 mottled females from such a cross are back-crossed to yellow white winged males, there are found among the F_2 off-spring males and females that are hyperploids.

The non-crossover hyperploid female has two yellow white singed X-chromosomes and the translocated fragment. She is therefore singed and red or mottled eyed, but never has notched wings. The non-crossover hyperploid male has the yellow white singed X-chromosome and the fragment. He is also singed and red or mottled eyed. The hyperploid males constitute the only class of males that show mottled eyes. A few yellow scute males appear in the cultures. This type of male has the broken X-chromosome and the translocated fragment. Such a male is never mottled eyed, because (apparently) the loss of the fragment during development results in the death of the zygote.

Linkage tests for the translocation demonstrate that the fragment is attached to the fourth chromosome. Cytological studies made by one of us (Painter) also reveal the presence of the fragment on the fourth in a female heterozygous for the translocation (a fact discovered before the linkage tests were completed). The metaphase plates of oogonial divisions show that the attached piece is about three times the size of a fourth chromosome (Fig. 1, a, b). In the nervous tissue of the same female larva, heterozygous for the translocation, cells have been found that show the translocation, while other nearby cells have normal fourth chromosomes, thus demonstrating that the translocated piece may actually become lost during morphogenesis.

FIG. 1, a and b.

From this brief account it will be seen that the mosaicism in this strain of flies is due to an *unstable translocation*. From the view-point of cytology, the case is of interest in that it gives us an opportunity to compare the physical size of the left end of the X-chromosome with its corresponding genetic or map size.

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THE EFFECTS OF X-RAYS ON THE GROWTH OF WHEAT SEEDLINGS

THE present study was undertaken to obtain quantitative results on the reactions of growing plants to x-rays under controlled biological and physical conditions. Wheat seedlings were used because preliminary experiments showed that the growing parts were relatively sensitive to x-rays and because the results under similar conditions were in close agreement. The roots elongate at the rate of about 1.3 mm an hour. Over two hundred thousand measure-