

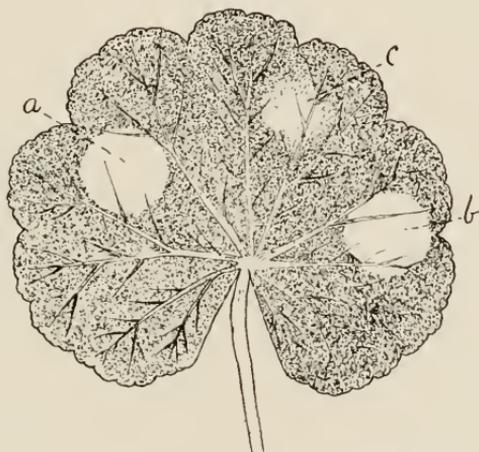
## AN INSTRUCTIVE MODIFICATION OF AN OLD EXPERIMENT.

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We have long been familiar with the experiment in photosynthesis of pinning a cork on opposite sides of a green leaf and exposing to the light in order to show that no starch is formed in the leaf where the cork shuts off the action of the sunlight. The experiment, further, has excited no little comment and criticism because of the fact that the cork, tin-foil, or other opaque screen as usually applied not only shuts off the light but also interferes with the interchange of gases through the stomata. This



Starch Distribution in Geranium Leaf—*a*. Opaque disks in close contact with leaf, shutting off both light and air;—*b*. Opaque disks with air space shutting off light but not air;—*c*. Glass disks in close contact with leaf shutting off air but not light.

consideration has led to various modifications of the experiment and to the development of some highly accurate and scientifically constructed pieces of normal apparatus to correct the error of the original experiment. So far is this sometimes carried that the construction and adjustment of the apparatus has completely obscured the significance of the experiment. We need, therefore, to get back to first principles, that is, to experimenting upon the plant instead of upon the apparatus.

The following simple modification of this classic experiment will be instructive and will usually set the student to thinking to some purpose. Prepare several round disks from opaque paper or light cardboard. These may be readily made of about the right size with a gumwad cutter. Selecting a broad leaved plant of suitable size, place a pair of the disks one on each side of the leaf opposite each other and in close contact with the surface of the leaf, and fastened in place by a light spring clip, such as is commonly used to fasten loose sheets of paper. Attach another pair of disks in a similar manner but supported from the surface of the leaf by wax feet or other supports so as to allow a free circulation of air between the disks and the leaf. Now select a couple of cover glasses, such as are used in microscopic work, of approximately the same size as the paper disks and attach these in a similar manner so as to be in close contact with the surface of the leaf. The plant is now exposed to the sunlight and after a time the leaf is tested for starch in the usual way with iodine. The result as obtained recently by my own students is shown in the figure.

As is seen the place of the opaque disks is marked by a spot free from starch and bounded by a sharply defined line approximately at the edge of the disk in both cases, showing of how little significance in this form of the experiment is the question whether the stomata are covered or not. On the other hand, the glass disks are marked by only a small spot at the center without starch and the intensity of the starch reaction shades off gradually from the margin toward this central spot so that the boundary of the disk is not evident. It is hardly necessary to add that some care should be exercised in timing the exposure to the sunlight in order to get the most striking results. The phenomena afford a neat little problem for the student to explain. With a little thought most students can do this if they understand clearly the structure of the leaf.

The experiment may be further elaborated with instructive results by selecting leaves with stomata definitely distributed as upon only one side of the leaf and by using the disks, both the glass and opaque, singly instead of in pairs.

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