The magnetic crescograph of Bose is very sensitive and is capable of magnifying growth 10,000 times. The use of a thread attachment with this instrument also has its objections. Certain projection apparatus eliminates the use of any attachments to the plant and is capable under favorable conditions of magnifying growth thousands of times. Its use is, however, limited and photographic registration is necessary for undisturbed records of growth in plants.

Cinematography has been employed successfully for many growth measurements, and Cine-photomicrography is also useful in cell growth.

## PRESERVATION OF DRY PLANT MATERIAL

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Material for plant study, as is often preserved in alcohol or other preservatives, to use for subsequent investigation, at times dries up entirely and is frequently then considered of no further value and is therefore generally thrown away. This is important since valuable and oftentimes irreplaceable material is lost. It is also at times a serious loss of time and much care and effort which may have been expended in fixing and preserving the material up to the point of dehydration of the alcohol used. It has been the writer's custom to bring the specimens gradually into 95 per cent alcohol and allow them to remain there until needed. It is inadvisable to allow bulky specimens to remain in alcohol of even 70 per cent, especially if there is a considerable quantity of them. The specimens should be separated from one another so that they will be completely surrounded by a large volume of alcohol, and this changed frequently as the process of dehydration slowly progresses. In the higher per cents of alcohol the specimens should always be left a longer time than in the lower per cents. Several days, at times and according to the nature of the material, is not too long to allow the specimens to remain in 70 per cent, and stronger per cents of alcohol even if the specimens are to be used at once, since it insures more gradual and more completely dehydration without damage to the material. Much of such material of plants which has dried out and generally supposed to be a total loss may be restored to a good condition if proper care is used as regards its structural features. In order to recover some plant material, that was of sufficient value, the writer has subjected the dried out parts of certain plants to a special treatment which has again rendered them available for certain studies from a structural standpoint. The plants used for this treatment were the stems of *Zea mays*, and *Cucurbita Pepo* and the leaves of *Iris versicolor*, *Iris cristata*, and *Sambucus canadensis* and the petioles of *Caladium bicolor*. All of these plants are of sufficient delicacy to allow of great shrinkage and distortion by complete desiccation. In addition to the above mentioned plants, branches from three to six millimeters in diameter of *Tilia americana* were also dried after having been in 95

per cent alcohol. Specimens dehydrated in 95 per cent alcohol dry quickly. The plants used here were kept dry for 30 days during which time the bark and wood of *Tilia americana* had partially separated. Soaking material in pure water only restores the natural conditions of the cell walls to a degree. The writer has resorted to the use of a strong vacuum pump. The specimens are first submerged in pure water, submerged by means of a glass weight and then placed under the glass receiver of the vacuum pump. The pump is then allowed to operate under as high a vacuum as possible, for different lengths of time according to the nature of the material. In some cases the pump was allowed to act 15 hours. For long periods of action of the pump it is advisable to mount as many specimens as possible under the receiving jar at one time. The strong action of the pump on the submerged specimen over a period of a few to many hours removes the air and allows the water to enter the tissues so that they generally resume their former appearance, in many cases, almost perfectly. It is a decided improvement over the method of simply allowing a set of tissues to soak in water. This method, of course, does not effect the cell contents, but applies to the readjustment of the cell walls and tissues. After such treatment the specimens must be carefully dehydrated in the usual way. The specimens may also be very effectively cleared during the action of the vacuum pump by observing the proper strength and length of time such clearing reagents as carbolic acid and chloral hydrate require. The addition of glycerine materially aids the clearness of the tissues if added to the water during the action of the pump. By the method outlined here valuable material may be restored as regards the form of cells and cell walls almost to its original condition so that the study of tissues is easily made.

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