the outside, as it is insoluble after hardening. Experiments upon the most rotten and fragile specimens, with control experiments with shellac, showed decidedly superior results. The presence of the Bakelite presents no obstacle to fitting fragments or to cementing fragments together by the means ordinarily used. One instance will illustrate the success of the method. A human skull was selected that the writer could have crushed in his hands; after treatment it was dropped upon a table top, cautiously at first, and finally from a height of eighteen inches upon its vertex without injury.

In the course of the experiments it was ascertained that porous specimens which had been treated in the field with shellac would still take the Bakelite and could be much improved. Bakelite could be used in the field, but is not so easily kept or handled as shellac.

Attention was then turned to an attempt to treat fine-pored material, as porous bone and plaster of paris. As the problem was the same in both cases the experiments were carried out on a series of blocks of plaster of paris, approximately three by two by one inches. It was found that the fine-pored material absorbed the thinner and rejected the more viscous portion of the varnish. Attempts to overcome this were made in several ways:

(1) By prolonged soaking. No good results.

(2) By incorporating sand, sawdust and the like to increase the porosity. No good results.

(3) By preliminary heating and allowing to cool in the varnish. No good results.

(4) By change of viscosity by increased dilution. No good results.

(5) By partial submergence only. No good results.

More complicated methods, such as treating in vacuum and prolonged boiling in a reflux condenser, have not as yet been tried as the processes would by their increased complication defeat the end sought, that of finding an easily applied method for saving fragile material. Such methods might be usable in cases of especially valuable material.

It was suggested that the lack of hardening might be in part due to the fact that the high temperature had started the breaking down of the plaster. An impregnated block was heated for fifteen to sixteen hours in an atmosphere of steam. It showed a considerably higher degree of hardening. Upon reporting these results to Dr. Baekeland it was suggested by his research staff that a different type of varnish, No. 2C, might penetrate the porous material more readily. Blocks were soaked in this varnish for thirty-one hours and then baked for twenty-seven. It was found that the surface was hard but not the interior; they were rebaked for twenty-seven hours, and it was found that the interior was so hard that it could be only scratched with some difficulty with a knife.

The value of plaster casts is frequently impaired by the fact that they are painted to preserve them; this method permits their hardening so that they may be handled and even washed without injury, and still preserve all the finest details.

The main value of the process lies in the fact that the most fragile material, as the unique human remains, may be preserved in a practically indestructible medium. An attempt was made to use the Bakelite in the preservation of recent bones, such as cracking teeth and warping bones, but it was found that the necessary heating was harmful; on the other hand, specimens of this kind have been treated with the Bakelite and the heating omitted; already, after one week, the stickiness of the varnish has disappeared and the specimens seem to be well bound together. In the course of a few months they will be as hard as the baked specimens.

It is hoped that these experiments will suggest methods by which the most fragile material may be rendered practically indestructible.

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SPECIAL ARTICLES

THE INOCULATION OF TOMATO AND TOBACCO PLANTS WITH POTATO MOSAIC VIRUS

THE appearance of mosaic disease in potato plants, under field conditions, is variable and indefinite, so that the question has been raised as to whether or not any potato plants are free from the disease and whether the signs are due to one or several diseases. Furthermore, while some investigators have been successful in transferring this affection in potatoes to tomato and tobacco plants, others have failed; so that at present there is a lack of uniformity of opinion concerning the relation of mosaic in potatoes to that in other species or genera of the *Solanaceae*. The characteristics of the disease in tobacco, however, are uniform and unmistakable. It seemed advisable, therefore, to determine whether or not the disease could be transferred from potato to tobacco and tomato, since, if the transfer could be made, it would be possible not only to test potato plants for mosaic but also to determine whether or not the irregular changes in the potatoes were due to several distinct diseases or were merely different manifestations of the same disease.

All the experiments were made with greenhouse plants at an optimum temperature of 28° to 30° C., except during one period, when, in combination with excessive dryness, a temperature of 20° to 22° C. prevailed. Then the tomato seedlings grew little, if any, and the inoculated plants failed to show the disease—thus confirming the results of Johnson, Allard and others that active growths are essential for revealing the signs of natural or experimental mosaic.

Nine supposedly normal tobacco plants[1] were inoculated by rubbing two or three of the leaves of each with freshly cut mosaic potato tubers from three separate sources. After eight to fifteen days all but two of these nine tobacco plants exhibited the signs of typical mosaic disease, which can still be observed at present—over six months after inoculation. At the same time twenty-two tobacco plants similarly treated with non-mosaic materials, which were not derived from potato plants, remained normal.

The mosaic potato tubers were allowed to sprout and when the leaves showed the picture of the typical disease, some were removed and were rubbed into two to three leaves of each of eight supposedly normal tomato plants. After eleven days, all these latter exhibited typical mosaic.

In addition eighteen tobacco seedlings, in series of three, were inoculated in the same manner with six tubers from separate potato plants which showed very slight, if any, manifestations of mosaic. It is important to note that after as long a period as twenty-seven to thirty-seven days, from one to three of each series, or a total of thirteen, exhibited the typical picture of this affection. With the exception of the long incubation period the disease in these plants showed no difference from that derived from markedly involved potatoes. This production of mosaic in tobacco from supposedly normal potatoes has recently been reported by Johnson.

The active agent, whether originally derived from potatoes, tomatoes or tobacco, reacted similarly in centrifugalization tests. In dilutions in distilled water of 1:1,000 which had a specific gravity of 1.004, or of 1:5,000 with a specific gravity of 1.001, the supernatant fluid, after two hours' centrifugalization at 3,000 r. p. m., could induce mosaic disease in normal tobacco plants as quickly, actively and constantly as the sediment.

We may conclude that the disease in potato plants can be transferred to tomatoes and tobacco from either the leaf or tuber. The signs in tomatoes and tobacco are identical, whether the inoculum is derived from plants which showed very marked mosaic or from those which exhibited signs so slight as to be dubious—a fact which should be borne in mind in the selection of mosaic-free plants, since potato plants are always propagated from tubers. Furthermore, the appearance of the experimental disease is identical with the natural affection in tomatoes and tobacco.

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[1] We have found that the species *Nicotiana affinis* ("jasmine tobacco"), a horticultural variety of *Nicotiana alata* ("winged tobacco"), which was employed in these experiments together with the Connecticut broadleaf variety of tobacco, is as susceptible to the disease as the latter, but once the affection is established the signs are much more prominent—thus making it an ideal plant for these transfer experiments.

NOTES ON THE TOPOGRAPHY OF THE GOLGI APPARATUS IN GLAND CELLS

DURING the last year and a half I have been engaged in an intensive study of the Golgi apparatus in secretory cells, following up the recent researches of Nassonov and my subsequent suggestions as to the homology of the acrosome with recognized secretory granules. Over twenty kinds of gland cells have thus far been examined, most of which can be roughly grouped, on the basis of the appearance of their secretory granules, in one or another of the three usual types—mucous, serous or lipoidal (so-called modified sebaceous glands).

Cells which may be roughly classified as of the mucous type have been studied in the salivary gland of Limax, in the red portion of the Harderian gland of the rabbit, in the intestinal epithelium of the salamander, in the submaxillary and tear glands of the cat, and in the Harderian gland of the duck. In the invertebrate, Limax, the Golgi apparatus is always represented by a large number of discrete Golgi bodies, which are scattered throughout the cell but always peripheral to the increasing accumulations of secretory granules. In late stages they accordingly occupy a position on the periphery of a large mass of secretory products, which practically fills the whole cell. In all the vertebrate gland cells, on the other hand, the Golgi apparatus begins as a simple network, which gradually enlarges as secretion progresses, but always retains the condition of a much reticulated network. This network tends to occupy a position peripheral to the mass of secretory granules, which, on completion, are gradually pushed away from the Golgi area by their successors, and thus accumulate in peripheral spaces of the cell often quite distant from the Golgi apparatus.

Cells, to be roughly classified as of the serous type, have been studied in the salivary gland of Limax, in the pancreas of the salamander, and in the parotid, submaxillary and pancreas of the cat. Again in the invertebrate, Limax, the apparatus consists of scattered Golgi bodies, which are present in very large numbers and, as the secretory cycle progresses, be-