On the basis of these experiments, one is tempted to draw certain inferences. It is very unlikely that there is any significant amount of insulin left in the tissues seven days after pancreatectomy, in view of the careful work of Best, Jephcott and Scott.[6] It may be postulated that there is present, initially, some factor or factors, inhibitory of carbohydrate oxidation, not by direct neutralization of insulin, but by a depression of some phase in the chain of carbohydrate oxidation. Unchecked by insulin in the diabetic organism, the effect is profound. During the incubation at body temperature *in vitro,* this inhibiting factor is somehow destroyed or lost to the cell. Whereupon the tissue can resume its full primitive potentiality for carbohydrate oxidation, without the need for participation of insulin in the process. In the normal tissue also, there is a factor limiting the extent of carbohydrate metabolism, whose influence wears off on incubation. Whether or not the increased carbohydrate oxidation in this case is due to unchecked insulin action or is independent of it can not be judged from this experiment. Basically, oxidation of carbohydrate can be divorced from the action of insulin, whose main function in the organism may be to act in an opposite direction to the inhibitory factors. This conception would fit in very well with the phenomena of the Houssay dog, or the adrenalectomized-pancreatectomized animal, as well as with the findings on the tissues of the Houssay dog reported above. It would help clarify the situation in human diabetes, where a pancreas, histologically intact and containing insulin, may be present. It would help explain the tenacity with which some tissues, particularly muscle, hold on to their carbohydrate stores in conditions such as fasting, instead of prodigally using up this easily oxidized substance.

But such tempting inferences must be tentative until there is much more in the way of experimental data. The phenomena reported could be due to a pathological state in the tissues, attendant on prolonged exposure to these relatively unphysiological conditions, or to changes in cell permeability. That the tissue may be damaged to some extent by the long period of incubation is apparent from the occasional depression of respiration which takes place.

It is the aim of experiments now going on in this laboratory to evaluate these several possible explanations of an interesting phenomenon.

EPHRAIM SHORR

DEPARTMENT OF MEDICINE, CORNELL
UNIVERSITY MEDICAL COLLEGE, AND
THE NEW YORK HOSPITAL

[6] Best, Jephcott and Scott, *Am. Jour. Physiol.*, 100: 285, 1932.

TRICHOMES OF INCIDENTAL IMPORTANCE AS CENTERS FOR LOCAL VIRUS INFECTIONS

STUDIES have been made to evaluate the importance of trichomes and other epidermal cells as points of entry for virus that causes local infections when the inoculum is wiped over the leaves of suitable species. Although the trichomes do serve as centers for local virus infection, their importance in comparison with other cells of the epidermis seems to have been overestimated.

Inoculations were made through the trichomes by cutting them from the leaf surface or mutilating them with a fine instrument while immersed in a small drop of fresh virus extract under a dissecting microscope, magnification 28×. Cutting 2,290 trichomes from leaves of *Nicotiana sylvestris* Spegaz. and Comes resulted in 2.2 per cent. positive local infections. Inoculations by mutilation of all the trichomes on small areas of leaves of *N. sylvestris, N. glutinosa* L. and *N. rustica* L. resulted in 35, 22 and 12 per cent. of the expected local infections, respectively. The expected number of infections was determined by wiping the inoculum over the opposite halves of the leaves on which the above tests were made.

Since trichomes are very sparse on the leaves of pepper, *Capsicum frutescens* L., it was possible to avoid them and inoculate small areas of the epidermis. These inoculations were made under a dissecting microscope by using an elbow bent in a fine flexible wire or a padded pin head to lightly rub the inoculum over the epidermis. Care was taken to avoid bruising or breaking trichomes or making wounds which might be apparent at this magnification. The ordinary cells of the epidermis were very susceptible to inoculation by a very light rubbing, since approximately the expected number of local infections was obtained.

The right halves of 47 *Nicotiana sylvestris* leaves were wiped with virus-free water and allowed to stand from two to six days before inoculation of the entire leaf by wiping. The first wiping of the right halves of the leaves destroyed about 95 per cent. of the trichomes and there was very little evidence that other cells of the epidermis had been injured. After inoculation it was found that the number of necrotic lesions was reduced 6.8 per cent. on the right halves of the leaves which were wiped twice in comparison with the left halves of the leaves which were wiped only at the time of inoculation. This experiment was repeated with 43 leaves, except that fine carborundum dust and water were used for the first wiping of the right halves of the leaves. This wiping destroyed about 98 per cent. of the trichomes, and many of the ordinary cells of the epidermis were severely injured or killed. After inoculation it was found that the number of necrotic lesions was reduced 31 per cent. on the right halves which were wiped twice in comparison with the left halves which were wiped only at the time of inoculation.

If trichomes were of major importance as points of entrance for inoculum, their destruction would be expected to cause a greater reduction than 6.8 per cent. in the number of local infections when leaves were inoculated later. The importance of the ordinary cells as points of entrance for inoculum is evident, since severe injury to some of them reduced the number of local infections 25.2 per cent. as compared to the 6.8 per cent. reduction when practically all the trichomes were severely injured or destroyed and little injury was observed in the ordinary cells.

Pepper and *Nicotiana sylvestris* leaves have approximately 16 and 346 trichomes per square centimeter, respectively. When pepper leaves were inoculated by wiping in the usual manner, 82.4 per cent. of the local infections showed no relation to trichomes. In contrast on leaves of *N. sylvestris* 39.87 per cent. of the lesions showed no relation to trichomes, 20.26 per cent. of the lesions had a broken trichome in the periphery of the lesion and 39.87 per cent. had a broken trichome in the center of the lesion.

It was pointed out earlier in this note that 35 per cent. of the expected number of lesions resulted on leaves of *Nicotiana sylvestris* when all the trichomes on small areas were inoculated without injury to other epidermal cells. This 35 per cent. is consistent with the 39.87 per cent. of the total lesions observed to have trichomes in their centers on the wiped leaves, and for this reason these lesions on the wiped leaves are considered to be the result of inoculation through broken trichomes. The 20.26 per cent. of the lesions having a broken trichome in their periphery are considered to be the result of an inoculation through an epidermal cell near to the trichome.

It is evident that many ordinary epidermal cells serve as infection centers and that the larger percentage of infections through trichomes of *N. sylvestris* is due to the greater number of trichomes on a given leaf area as compared to pepper.

L. W. Boyle
H. H. McKinney
Bureau of Plant Industry
U. S. Department of Agriculture

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE DEVICE FOR MEASURING THE ABSORPTION RATES OF SOILS

A fundamental factor in determining the extent of run-off and erosion from western watersheds in times of torrential rain or rapid melting of snow is the rate at which the soil will absorb surface water and conduct it into underground channels, where it ceases to be an erosive agent but percolates to the vast soil and rock reservoirs which feed the springs. Recognizing the important rôle played by this soil function in watershed management, the Intermountain Forest and Range Experiment Station has developed an apparatus to measure the rate of absorption with a minimum of disturbance to the soil. The unit is inexpensive to construct, simple to operate, and its small size and light weight permit the study of soils in their undisturbed state on areas accessible only by foot.

The apparatus includes a water reservoir (Fig. 1 *a*), made by grinding the bottom from a quart bottle, and a distributor (*b*), built of ¼-inch brass pipe and fittings, which delivers water in a thin sheet to the upper side of a one-square-foot plot enclosed by suitable baffle plates (*c*). As the water flows over the plot some is absorbed at a rate determined by the nature of the soil, the steepness of the slope and the kind of vegetation present; and the excess passes into the run-off trough (*d*) and a manually operated tipping bucket (*e*), where its rate of flow is measured. The difference between the rate of application and the rate of run-off is the rate at which water has been absorbed by the soil.

The rate of application is controlled by a globe valve and is determined by observing the time required for successive measured portions of 300 cc each, contained in cans (*f*), to pass through the distributor. At the start of a run, the reservoir is filled to the level of the pointer (*g*) and one measured portion is added. When, after the application is started, the water level again drops to the tip of the pointer, the delivery of one measured portion is indicated and the elapsed time is recorded. Another measured portion is then added and the run continued. The variation in head caused by the intermittent addition of portions of water has no significant effect upon the rate of flow through the system.

At the termination of each time interval during which a measured portion of run-off has been applied to the plot, the tipping bucket is tipped so that the run-off from the next 300 cc application is caught in a separate container. Subsequent measurements of these run-off portions indicate the rate of run-off, and by subtraction from the rate of application, the rate of absorption is determined.

After the first one or two minutes of the run, the absorption rate of the plot becomes nearly constant, and can be compared directly with corresponding rates on other plots. Replicate determinations on the