type, while slender-limbed strains with a fine narrow face, a well set-on tail and a mane that clings to the neck, probably most accurately reproduce the variety of *E. gracilis* which in prehistoric times inhabited north Africa.

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The Etiology of Plant Tumors: ERWIN F. SMITH. (Illustrated by numerous stereopticon photographs.)

The author prefaced his remarks with the statement that Dr. C. O. Townsend and Miss Nellie Brown were associated with him in the prosecution of this research. The address consisted of a series of lantern slides with running comment. The slides showed inoculated plants of various species and of widely different families, the growths in all cases being the result of pure culture inoculations of the schizomycete *Bacterium tumefaciens*. The crown gall of cultivated plants is cross inoculable to an astonishing degree. In susceptible tissues the signs of these galls appear within as short a time as four or five days. The tumor continues to grow for several months and in some cases for several years and may become 5 cm. or more in diameter. Hundreds of pure culture inoculations have been made. The organism cultivated from the Paris daisy has been inoculated many times successfully into the same and also into the peach, rose, hop, sugar-beet, white poplar and other susceptible plants. That from the crown gall of the peach has been many times successfully inoculated into the peach, and also into the Paris daisy, sugar-beet, hop and other plants. The schizomycete from the hop has been inoculated successfully into the hop and into the Paris daisy, sugar-beet and other plants. One of the astonishing things about this crown-gall organism is the number of families which are subject to infection; in other words, the very simple and generalized nutritional needs of the parasite. In some ways it resembles the root-tubercle organism of Leguminosæ, but is not identical. It has been inoculated into clovers with the production of knots. Quite recently from the hard gall of the apple (selected by Dr. Hedgcock) we have isolated an organism which appears to be like that occurring in other crown galls, and with this, hard galls have been produced upon the Paris daisy. A similar if not identical organism has also been isolated from the hairy root of the apple and successfully inoculated into the sugar-beet, *i. e.*, with the production of similar root-tufts at the point of inoculation. There is now little doubt, therefore, that the hairy root of the apple is also of bacterial origin.

Metastatic growths occur on these plants, but up to this time we have not definitely determined the channels of infection from the primary tumor to the secondary ones. These are easily discovered in the case of the olive-tubercle, but are not readily found in case of these crown galls. The same remark is true respecting the bacteria in the primary tumors. They are very abundant and easily discovered in the olive-tubercle, but not readily detected in the crown gall, although obtainable therefrom in Petri dish cultures on agar. It is still too early in the course of our studies to make positive statements respecting the likeness or unlikeness of these growths to malignant animal tumors, but it is proposed to continue this phase of the inquiry. There is in these growths a very rapid multiplication of parenchymatic tissues with reduction and distortion of the firm conductive tissues of the plant and the final decay and sloughing off of the spongy tissues, leaving open wounds, on the margins of which fresh developments of the tumor may appear.

Seed Corn as a Means of Disseminating Bacterium Stewarti: ERWIN F. SMITH.

In the summer of 1908, in a hothouse on the grounds of the Department of Agriculture, the writer succeeded in obtaining from plants grown from a suspicious seed corn eight times as many cases of Stewart's disease as from plants grown from disinfected seed taken from the same sack. The plants were treated in all respects exactly alike, except that a portion of the seed corn was planted without disinfection and other portions were subjected for ten minutes and fifteen minutes to 1:1,000 mercuric chloride water. The mere statement that there were eight times as many cases in the plants grown from untreated seed by no means expresses the whole truth, because in the plants grown from treated seed all the cases, with four exceptions, were very slight ones, every plant being reckoned as diseased which showed a

[1] In session December 29–31, 1908. These abstracts were received after the general report of the society had been printed in the issue of SCIENCE for June 25.

trace of the yellow slime in the bundles of the stem, although most of the plants so included contained very few affected bundles and did not yet show distinct secondary signs. In the plants grown from untreated seed there were many severe cases of the disease, the entire foliage being dried out and the bacterial multiplication in the vessels of the stem being several thousand times as much as in the cases which appeared in the treated plants. The seed corn was considered as suspicious for two reasons: (1) earlier in the season some plantings in Virginia made from this particular sample yielded many diseased plants, and (2) the corn was grown by a man to whose farm the writer traced a similar outbreak of this disease some years ago.

Various yellow bacteria were obtained from the surface of this corn by means of agar poured-plates, but not *Bacterium Stewarti*, although many attempts were made to isolate it. The latter consequently could not have been very abundant, at least in a living condition, and this may in part account for the small number of cases obtained (10 per cent.). The total cases on the untreated plots were 185 out of 2,017 plants; on the treated there were 36 cases out of 2,370 plants, 32 of these cases being only slightly diseased.

The Occurrence of Bacterium pruni in Peach Foliage: ERWIN F. SMITH.

Some years ago the speaker made inoculations (by spraying) on the foliage of some peach trees standing in his back yard. The schizomycete used was derived from the black spot of the plum. The sprayings were made late in July, at sunset in rather dry weather. The trees were not covered by tents and the spraying was not continued through the night, as it should have been. The next morning the foliage was dry. After some days, a few bacterial leaf spots developed on one of these trees—perhaps fifty altogether, and a microscopic examination demonstrated the presence of pockets of bacteria in some of these spots, but the experiment was considered in the light of a failure because very few spots appeared in proportion to the amount of culture fluid used, and none at all on one of the trees. Subsequent studies on plums led to the belief that the reason for this failure was due to the age of the foliage and to the fact that the moisture did not remain sufficiently long to secure many infections. In the summer of 1907 these experiments were repeated in one of the hothouses of the Department of Agriculture under conditions which could be more readily controlled. Healthy seedlings and grafted plants of two ages were placed close together on a bench in one corner of one of the hothouses, and heavy canvas was hung in front of the two exposed sides of the bench, so as to make an enclosed area which could be kept moist. River water was then syringed upon the plants (the same that the plants had been in the habit of receiving) and afterwards water dilutions of pure cultures of *Bacterium pruni*, obtained from Arkansas plums. The tent cloth was kept on for two days and the sprayings were repeated at intervals, so that with the exception of two short periods during which the foliage became dry by accident, the moisture was retained upon the leaves throughout the time that the tent cloth was employed. The result of this experiment was the appearance, after a number of days, of several thousands of typical leaf spots. A microscopic examination of many of these spots demonstrated a great number of bacteria in the center of the same, and poured-plate cultures were made therefrom. To obtain numerous spots it is necessary to make inoculations early in the growing season, that is, in May, and to keep the foliage moist from twenty-four to forty-eight hours. The spots obtained on the peach leaves differed in no way from those occurring naturally on peach, and there can be no doubt that the leaf spot of peach is identical with that of the black spot of the plum, both being due to *Bacterium pruni*. All of my experiments, however, have been made with the organism taken from the plum.

Two Sources of Error in the Determination of Gas-production by Microorganisms: ERWIN F. SMITH.

1. Some microorganisms produce gas from inosit (muscle sugar), consequently in bouillon agar shake-cultures, to which various sugars have been added, the resulting gas bubbles can not be attributed to the sugar added until it is known (*a*) that inosit does not occur or (*b*) that the organism is incapable of fermenting inosit.

2. Some gas-forming microorganisms, *e. g.*, a yeast recently isolated by the writer, do not liberate gas unless the cultures are shaken or stirred, *e. g.*, with a platinum needle. Then gas is evolved abundantly. Ignorance of this fact might sometimes lead to error. It is a fact well known in the Caucasus that the kefir ferment takes place most satisfactorily if the leathern sacks are frequently shaken, and it is said to be the habit for each member of the family to give the sack a kick in passing by it.