tory become a branch of the Carnegie Institution and should Dr. Gardiner be retained as secretary, he should receive a salary.

Dr. Gardiner sends his letter to the 'Editor of Science,' but addresses me personally. The editor of SCIENCE, as representing the policy of the journal, is responsible for the acceptance of my article for publication, but not for the opinions expressed in it.

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COLUMBIA UNIVERSITY.

ORANGE COUNTY MASTODONS.

MR. GORDON will, I trust, pardon me for saying that he is mistaken in supposing that the bones of the last three mastodons discovered in Orange County were found in their proper relative positions. The Schaeffer specimen was scattered over about thirty by fifty feet and the greater portion of three legs was never found. The Monroe specimen is sadly incomplete and there is reason to suppose that part of it is a hundred yards away from where the tusks were discovered. Finally, the entire hind legs of the otherwise fine animal at Yale have never been recovered. There is also a specimen at Vassar that I believe came from the vicinity of Newburgh, and this too is incomplete.

It is possible, however, that Mr. Gordon has reference to the Peale specimens, and these, I believe, were fairly complete. If it is to these that Mr. Gordon refers, the mistake is on my part. F. A. LUCAS.

WASHINGTON, D. C.,
October 10.

SHORTER ARTICLES.

THE BITTER ROT DISEASE OF APPLES.

ON July 10, of this year, Mr. R. A. Simpson, an agent in the employ of this laboratory, called our attention to the fact that the bitter rot spores which infected the apples in his orchard at Parkersburg, Ill., seemed to come from canker-like formations on the limbs of the apple trees. The bitter rot was first observed by him July 9. An examination of the trees on which the rot had appeared showed that in almost every instance it was possible to trace the infection to such a canker. The tracing was comparatively an easy matter, as the first lot of infected fruit usually occurs distributed in the form of a cone, with its apex towards the top of the tree. Although it seemed probable from Mr. Simpson's discovery, which was verified and extended by us several days later, both in the orchard at Parkersburg and elsewhere in Illinois and Missouri, that a causal relation existed between the cankers and the bitter rot disease of the apples, it was not thought sufficiently well proven at that time to warrant publication. Examinations of the cankers showed the presence of pycnidia containing the characteristic pale bitter rot spores, likewise of numerous spores of *Sphæropsis malorum*, of a species of *Alternaria* and spores of several other fungi. In the cultures made from numerous cankers *Glœosporium fructigenum* appeared in every instance.*

At first conidia borne free on short hyphal branches appeared in the pure cultures, and later on the pink masses of spores usually found on diseased fruits. When kept for some time, the fungus in these pure cultures produced perfect perithecia and asci. Mycelium which produces perithecia and asci when transferred to fresh apple agar, will continue forming perithecia, the latter appearing in such fresh cultures seven to eight days after the transfer. Inoculations were made into the bark of healthy apple trees about the middle of July, with spores from pure cultures obtained from the cankers. At the same time apples were inoculated with these same spores. In the course of a week the infected apples showed every sign of the bitter rot disease as found out of doors. Inoculations were likewise made with *Glœosporium* spores taken from apples recently attacked in the orchard, both into healthy apples and into growing apple branches, at the Missouri Botanical Garden. Inoculations into the branches were made by making shallow cuts through the bark, and inserting a needle point covered with spores into the cut. Control cuts were made for every inoculation, distant but two to three inches from the infected cut. At first little difference was noticeable between

* Most of the cultures were made by Mr. Geo. G. Hedgcock, assistant in pathology.

infected cuts and the control cuts. After a week or more the bark around the infected cuts turned brown and black; it gradually dried and became more or less depressed. The branches inoculated with *Glœosporium* spores from apples showed unmistakable signs of canker formation about four or five weeks after the inoculation. Small black acervuli were noticeable about the edges of the shriveled bark, which were found to be true *Glœosporium* pycnidia. Inoculations were thereupon made with spores from these cankers, into apples, and these showed the characteristic bitter rot disease a week later.

The branches inoculated with *Glœosporium* spores from pure cultures (made from cankers taken from orchards) showed the formation of exceedingly striking cankers by the beginning of September. These cankers had numerous pycnidia with mature spores, which, when inoculated into apples, produced the characteristic bitter rot disease with pycnidia. One must add that, with the very large number of inoculations made, not a single control cut or puncture showed any signs of disease.

The cycle of infections made may be recapitulated briefly, as follows:

1. Spores of *Glœosporium fructigenum* from apples affected with the bitter rot disease, inoculated into living apple branches produced an apple canker with *Glœosporium fructigenum* spores, and the latter inoculated into healthy apples produced the bitter rot disease.

2. Pure cultures of *Glœosporium fructigenum* were obtained from apple cankers in the orchard. The spores from such pure cultures, when inoculated into living apple branches, gave rise to apple cankers with pycnidia and spores of *Glœosporium fructigenum*. These spores, inoculated into apples, produced the bitter rot disease.

It appears from these preliminary studies, that there is a causal relation between apple cankers found in numerous orchards and the bitter rot disease, and that it is very probable that this fungus is capable of living both in the bark and the fruit of the apple. This fact will be an important one in assisting apple growers to combat the disease.

The details of the cultures and the observations, together with illustrations, and a discussion as to the relationship of the various stages of this fungus and its host, are to be published in full before long.

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THE TERTIARY OF THE SABINE RIVER.

THE results of Dr. Veatch's work in the Tertiary deposits along the Sabine River, as published in the 'Report of the Louisiana Geological Survey,' 1902, are of great value in clearing up the stratigraphy of that region and in showing the presence of deposits of Jackson age in the Eocene of Texas, where they had not been recognized with certainty by earlier observers.

In his correlation of these deposits with the general Texas section, on page 141, he uses Kennedy's table. In this the reference of certain east Texas materials to the Fayette and Frio beds was made entirely on account of lithological similarity and supposed stratigraphic equivalency, but subsequent work has shown that they do not belong to those horizons, but to others of much later date.

In Texas, the area occupied by the outcrop of deposits of Lower Claiborne is so immense that it has been found convenient to break it up into four substages: The Marine, Yegua, Fayette and Frio. These four substages outcrop for more than thirty miles on the Brazos river and for no less than one hundred and thirty miles on the Rio Grande. They are all fossiliferous, and the great number of fossils collected from the first three, and determined by Professor Harris, proves their Lower Claiborne age conclusively. Professor Harris also placed the Frio clays in the same stage on the basis of such fossils as we obtained in it, and we so hold it.

These beds are usually overlain directly by Neocene deposits.

Loughridge, in his report on Cotton Production in Texas (Tenth Census Report), gave a brief description of the Miocene beds as then known, and outlined the northern