those whom he does not bring back, a circumstance which renders the chiefs more careful in leading their warriors." Smoking the calumet is associated with preparation for war and with peace treaties. The Natchez language appears to be the result of a mixture between a Muskhogean and a non-Muskhogean people.

The Chitimacha were less warlike and more cowardly than the tribes higher up the Mississippi; their culture differed from the latter principally by the increased importance of food from the waters and the decreased importance of food from land animals; but wild vegetable food was their mainstay, though they cultivated maize and sweet potatoes. Fish were caught mainly with hook and line, but nets and traps were used. The blowpipe was employed, the darts of which were made of slender pieces of cane feathered with thistledown (Fig. 1). Pottery was made; but the chief glory of the Chitimacha was, and still is, their basketry (Fig. 2). Like some other tribes of the district, there were nobles and commoners, with different terms of etiquette for each; but, unlike the Natchez, their nobles were constrained to take partners from their own ranks, thus forming a caste. Matrilineal totemic clans existed. Every village of any size had a bone-house, in which a fire was kept continually burning. The bones of people were dug up by "turkey-buzzard men" and kept in the house for some time, and finally buried in a mound. Every large village had also a dance-house for religious and social ceremonies, as, for example, the initiation of boys. Different from this was the solitary fast and confinement which each boy (and, it is said, each girl also) underwent in order to obtain a guardian spirit. The so-called "temples" of the Natchez and other Lower Mississippi tribes were only variants of the bone-houses of the Chitimacha and Choctaw. Further study may be expected to throw light upon the evident fusion of at least two stocks in the tribes recorded by Mr. Swanton. A number of old illustrations are reproduced, but many of the photographs are not very satisfactory; there is a useful map.

The excellent archæological work of Dr. Fewkes in exploring and conserving cliff-dwellings has been referred to already in NATURE. In Bulletin 50 he gives an account of his stewardship of the Navaho national monument in Arizona. The excellent illustrations to his report bring home to the reader the great interest of these remarkable remains (Fig. 3). He makes some suggestive remarks upon the significance of the dwellings. "The ancients chose this region for their homes on account of the constant water supply in the creek and the patches of land in the valley that could be cultivated. . . . Defence was not the primary motive that led the sedentary people of this canyon to utilise the caverns for shelter . . . the cause of their desertion was not so much due to predatory enemies as failure of crops or the disappearance of the water supply." Dr. Fewkes does not regard these ruins as of great antiquity; such evidence as has been gathered supports the Hopi legends that the inhabitants were ancient Hopi belonging to the Flute, Horn, and Snake families.

A. C. HADDON.

BACTERIAL DISEASES OF PLANTS.

THE second volume of Dr. E. F. Smith's work upon bacteria in relation to plant diseases, published by the Carnegie Institution of Washington, comes very opportunely to this country at a time when there are signs of an awakening interest in the subject of bacterial diseases of plants, and botanists, especially those interested in agriculture or horticulture, are beginning to turn their attention to the many economic problems in connection with this branch of phytopathology. The first volume, published in 1905, the author states, "had for its aim only the clearing of the ground by a discussion of methods of work in the general subject of bacteriology."

Although this department of botanical study is only some thirty years old, a considerable literature has arisen, even when the subject is taken in its narrowest sense, but when it includes, as in this case, many correlated topics, the list assumes large dimensions. Everyone interested in plant pathology will be grateful to Dr. Smith for bringing these papers together and for giving us a book of reference which has been long needed, and which embraces a concise historical account, leading up to the present position of the subject and embodying the most recent developments in this branch of research. A special feature of the book is the author's plan of including abstracts of many of the papers quoted, often of very considerable length, so that direct appeal can thus be made to original investigations; and although this method demands much space, the advantages are great, especially where controversial matter is being considered. Thus, under each sectional head, the author introduces extensive extracts from those original papers which he regards as critical studies, and concludes with a synopsis of the latest contribution to the particular phase of the question dealt with, adding always an extremely valuable bibliographical record. In the historical review Dr. Smith has missed the fact that the existence of a toxin and cytolytic enzyme secreted by the attacking bacterium was proved as early as 1899 as regards the "soft-rots," and in conjunction with carefully conducted

FIG. 1.—Crown gall on daisy.

Two tumours on the stem of a Paris daisy as the result of an inoculation of *Bact. tumefaciens* by needle-pricks, and on a branch above the upper one a secondary tumour on the petiole of a leaf. Age of primary tumours about three months; that on the leaf is much younger, perhaps four weeks old.

inoculation experiments; thus the bacterial nature of this class of diseases was fully established at that date.

The present treatise covers a wide field, and questions relative to the action of bacteria upon various tissues, the reactions of the plant, the interrelations of animal and plant parasites, individual and varietal resistance, and problems relating to prevention, come naturally within the scope of the work. A discussion of the various theories regarding the root-nodules of the Leguminosæ, and the question of symbiosis as it touches parasitism, are also usefully introduced, and the large chapter devoted to this relationship presents a valuable summary of results. But a *résumé* of conflicting views concerning bacterial symbiosis in insectivorous plants can scarcely be included under the titular definition of the book, nor the bacterial symbiosis in Cryptogams, as, for example, in kephir and the ginger-

beer plant. Though exceedingly interesting and important to botanists, these discussions are rather foreign to the main theme, and might with advantage have given place to a further treatment of definitely established diseases, and more unity and balance would thus have been secured.

In seeking for some convenient classification of various diseases, the natural division into three large groups is adopted:—(1) the vascular diseases; (2) the parenchyma diseases without hyperplasia; and (3) cankers, tubercles, and tumours, in which there is a more or less distinct hyperplasia. Under the general considerations involved in a study of these forms of parasitism, such as the methods of infection and progress of the disease, the destruction of tissues and dissolvent action of enzymes, abnormal development of host tissues, &c., a great number of bacterial diseases are dealt with by way of illustration, but only three specific diseases are fully described as such. These —the wilt of cucurbits, the black-rot of cruciferous plants, and the yellow disease of hyacinths—belong to the vascular group, and are discussed in fullest detail with respect to the specific characters of the organism, the etiology of the disease, the morbid anatomy, geographical distribution, and remedial treatment, including an estimate of financial loss for which they are responsible. The account of the cucurbit wilt represents Dr. Smith's own work, and he has also carried out much original research upon the other special diseases enumerated. The three are placed each in separate chapters, and together occupy more than one-third of the whole volume. Perhaps we may look forward at some future date to a third volume dealing more completely with other important types.

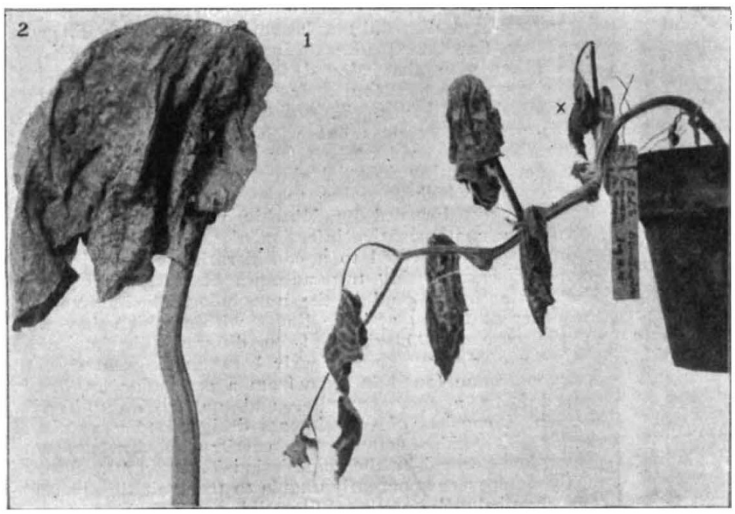

FIG. 2.—Wilt of cucurbits.

1. Cucumber-plant infected with a pure culture of *B. tracheiphilus* plated from the stem of a squash-plant. Plant inoculated August 10, 1905, by needle-pricks on blade of leaf marked ×. Photograph made on August 22. The vessels of the stem were plugged with a sticky white bacillus, which was plated out. Surface of stem sound. About one-sixth natural size.
2. Cucumber-leaf inoculated with *B. tracheiphilus* by *Diabrotica vittata* night of August 17, 1905. Blade shrivelled in some places and wilting in others. A natural infection. Photographed August 26, about half-size.

The most notable recent work on bacterial disease is that by Dr. Smith upon the crown gall, and a very interesting epitome of his latest paper is included here. This brilliant piece of investigation has established beyond all question that the tumerous disease known as the crown gall (Fig. 1) is of bacterial origin, and the phenomena in connection with this type of bacterial disease appear, in the author's own words, "to throw a flood of light on the mechanism of the development of malignant animal tumours."

The book is fully illustrated by expressive drawings and photographs, made chiefly from material in the author's own laboratory. Two of the illustrations are here reproduced.

M. C. P.

THE PROGRESS IN OUR KNOWLEDGE OF THE TRANSMISSION OF SLEEPING SICKNESS AND OTHER TRYPANOSOME DISEASES IN AFRICA.[1]

THE latest report of the British Sleeping Sickness Commission is the outcome of the work of Colonel Sir David Bruce, Captains A. E. Hamerton, H. R. Bateman, F. P. Mackie, and Lady Bruce, the members of the third commission to Uganda during the years 1908–10. It is highly satisfactory to find that, in the volume before us, a distinct advance is recorded in our knowledge relating to important etiological questions connected with the spread of sleeping sickness and of certain animal diseases due to trypanosomes.

An introduction, illustrated by photographs, describes the chief features and arrangements of the camp at Mpumu, which was made the headquarters of the commission. The body of the work is divided into ten sections, the more important sections each comprising several groups of experiments. In a few cases these subdivisions represent the continuation or elaboration of an experiment previously recorded (in Report No. x.); in such, the result obtained from the original experiment is first of all briefly recapitulated. At the end of the volume is a comprehensive analytical index (to both Reports x. and xi.) which will be found very useful.

The first section (A), which is in many respects of the greatest interest, deals with the development of *Trypanosoma gambiense* and other trypanosomes in *Glossina palpalis*, and the question of their transmission by this tsetse-fly. As regards *Trypanosoma gambiense*, the following important conclusions are reached by the commission. Mechanical transmission, that is to say, transmission by means of interrupted feeding, plays a much smaller part, if any, in the spread of the parasites (and consequently of sleeping sickness) than has hitherto been supposed. After the first few hours, the bite of the fly was found to be non-infectious until at least twenty-eight days had elapsed since the fly fed on the original infected animal.[2] At the end of this "incubation period" the fly may become infective, and may retain its infectivity for at least ninety-six days. This means that the developmental cycle of the parasites in the insectan host was found to take about twenty-eight days, and only when this development was completed could the infection be transmitted back again to the vertebrate host. Once a fly becomes infective, it appears only too likely that it may remain infective for the rest of its life. On the other hand, against this alarming result may be set the fact that only a small proportion of flies (laboratory bred) appear to become infective, the commission having found that the trypanosomes develop only in about 1 in 20 of such flies fed on an infected animal; and the proportion of infective to non-infective flies occurring wild in nature is very much less, probably not more than 1 in 500. An interesting account is given of the various developmental phases of the parasites observed in the different organs of the fly. Stress is laid by the commission upon one fact, namely, that in the salivary glands, and in them alone, were the trypanosomes found to revert to the blood-type. Further, the occurrence of this type of the parasites in the salivary glands was found to coincide, broadly speaking, with the onset of permanent infectivity of the fly. The commission consider that without this invasion of the glands there can be no infectivity, and that the reversion of the parasites to the blood-type is

1 Reports of the Sleeping Sickness Commission of the Royal Society. No. xi. Pp. 294+15 plates, text-figures, and maps.

2 It may be mentioned that Kleine and Taute, associated with the German sleeping-sickness Commission, have found that flies may become infective about twenty days after being fed. This variation in the incubation-period is probably dependent on variations in the surrounding conditions, food, &c.