the Japanese are not liable to scarlet-fever, and the negroes are equally exempt from yellow-fever, if we could ascertain what condition it is that confers upon them this exemption, we might be able to take a long step in the direction of personal and general prophylaxis. There is no more vital question, none more attractive to the most active minds of the medical profession to-day, than this of immunity; and in the direction of ethnic immunity there lies a wide avenue for investigation promising to lead to results of the utmost utility to the health and welfare of mankind.

The Builders of the Great Zimbabwe Ruins.

Among the auriferous reefs of Mashona-land, in south-western Africa, about 20° south latitude, are found a number of remarkable ruins of well-built stone cities, towers, and forts, which have long been an enigma to archæologists. Needless to say, they were not constructed by any Austafrican people; no negro or negroid race ever built stone walls voluntarily. The problem seems to be solved by the researches of J. Theodore Bent, which are published in the last number of the Proceedings of the Royal Geographical Society. He visited and explored the ruins of the largest city, called the Great Zimbabwe. This being a word of the local dialect, meaning krall or town.

His excavations show that these ruins were built and occupied by a people engaged in gold-mining. Crucibles and smelting furnaces were found, and in the vicinity "millions of tons" of quartz have been worked over. The stone work is massive, very firm, the stones often carved and decorated, and the sites usually of great strategic strength. Many images of birds, carved in stone, and also many phalli, in the same material, were unearthed. Pottery was abundant, the fragments often decorated with neat designs of animals, plants, and scenes from life. No coins were exhumed, and no inscriptions discovered, except some rude scratchings on a bowl, which resembled Ogham characters. What is significant, is the presence in the *débris* of Persian and Chinese Celadon pottery, which is not of very ancient date. Bent's conclusion is that the gold-seekers were Himyarites from southern Arabia, and that their settlements were destroyed by the savage Zenj from Abyssinia about the ninth century of our era.

Many consider this to be the Ophir of the Hebrews. An interesting visit to it, not mentioned by Bent, is described in the *Verhandlungen* of the Berlin Anthropological Society for 1889, carried out by a young German named Posselt. Both accounts present engravings of carved stones, figures of birds, etc.; but it is singular that neither explorer could find a single grave or skeleton of this ancient people.

THE PROPER MOTIONS OF THE STARS.[1]

BY W. H. S. MONCK.

SOME time since I pointed out in the columns of the *English Mechanic* the great preponderance of proper motions in diminishing right ascension in certain catalogues which I examined. I have now examined O. Struve's great Pulkova Catalogue, which contains the proper motions of nearly 2,500 stars, with a similar result. About two-thirds of these motions are in decreasing right ascension. I suspect that the sidereal year has been under-estimated by a small fraction of a second, in consequence of which a star whose proper motion is really insensible appears to have a small motion in decreasing right ascension. The effect of the sun's motion in space is very evident in the Pulkova Catalogue. The right ascension of the apex of the sun's way (the Americans use the shorter term, goal) may be roughly taken at 18 h. The effect will be to produce an apparent motion in diminishing right ascension on all stars between 6 h. and 18 h., and an apparent motion in increasing right ascension on all stars between 18 h. and 6 h. Diminishing right ascension predominates in both cases, while in the latter the excess is only about 20 per cent.

I noticed, however, a curious fact as regards the motions in North Polar distance. The sun's motion produces an apparent increase in North Polar distance in all parts of the sky save the portions situated between the apex and the North Pole on the one hand, and between the antapex and the South Pole on the other. But taking the right ascension of the apex at 18 h., as before, the motions in North Polar distance ought to be symmetrically situated between 6 h. and 18 h. and between 18 h. and 6 h. But this is not the case. Between 18 h. and 6 h. the proportion of increasing to diminishing North Polar distances is two to one, while between 6 h. and 18 h. it is only about four to three. It occurred to me that this difference might arise from some special drift in the stars of the Galaxy, of which a comparatively small number lie between 6 h. and 18 h. in the Pulkova Catalogue, which deals chiefly with northern stars. I accordingly tried Mr. Stone's "Catalogue of Southern Stars," which so far verified my conjecture. The great preponderance of increasing North Polar distances in it lie between 6 h. and 18 h., and the relative proportions are not very different from those in the Pulkova Catalogue reversed. Further examination will be necessary to clear up the question; but I venture to suggest that the Galaxy has a southerly drift relatively to the majority of the non-Galactic stars, and that we would obtain different goals for the sun from the Galactic and the non-Galactic stars.

May I add that in dealing with the fixed stars our present unit of distance—a year's light-passage—seems to me inconvenient. Besides the advantage of having a space unit instead of a time unit, and the existence of some little uncertainty as to the rate of propagation of light; we must recollect that our standard of measurement is the distance of the sun from the earth. The time occupied by light in traversing this distance is uncertain to the extent of at least two or three seconds, and the difference becomes considerable when we are considering very remote bodies. I venture to suggest as a better unit the distance of a star having an annual parallax of 1″. This distance is 206,265 times that of the sun. The distance of α Centauri on this scale is about 1.33 and Sirius about 2.5 We should seldom, if ever, have to use numbers as high as 1,000, and the reciprocal of the parallax expressed in fractions of a second would in all cases give the distance.

[1] From the English Mechanic, May 27.

THE PEAR-TREE PSYLLA.

BY J. A. LINTNER.

UNTIL within a few years the pear-tree has been remarkably free from insect attack, the amount of injury from such source being probably less than five per cent of that to which the apple has been subjected. Recently two pests have forced themselves upon the notice of pear growers, which have already inflicted serious losses, and threaten, unless arrested, greatly to interfere with the cultivation of this most excellent fruit. Of these, the pear midge, *Diplosis pyrivora*, which was introduced in this country about the year 1880,

has not become broadly distributed, and has not occasioned much trouble except in western Connecticut and in portions of the Hudson River valley.

The pear Psylla, *Psylla pyri*, also an importation from Europe, has been with us at least from 1850, when, as recorded, it infested an old Virgalieu pear-tree in Greenbush, N.Y. Since then it has become quite widely spread, and seems to be rapidly increasing in number and in the injury that it is doing. It was very destructive last year along the Hudson River in Columbia and Greene Counties. Mr. Powell, an extensive fruit-grower in Ghent, Columbia County, has stated that it reduced his pear-crop from an estimated yield of twelve hundred barrels to an actual one of less than one hundred barrels. Mr. A. F. Coe, of Coe Brothers, owners of large orchards in Meriden, Conn., has written me that on his return from Europe last September, he found that two of his pear orchards had been devastated by the Psylla.

It is a small suctorial insect, somewhat resembling in size and in its transparent steep-sloping wings the typical plant-louse, but is readily distinguishable from that in its being a jumping insect, whence it has been given the name of *Psylla*, meaning in the Greek a flea. Its injuries are caused by the large amount of sap which the myriads of individuals draw from the twigs, buds, leaves, and leaf-stalks of an infested tree, and the "honey-dew," which it freely deposits, thickly coating the surface and thereby preventing the normal vital action of the bark and leaves.

Without consuming space with a detail of so much as is known of its life-history, suffice it to say that at the present time, or about the middle of June, the insect in its four stages of egg, larva, pupa, and imago may be found upon infested trees, and an abundant deposit of the honey-dew. Later in the season the winged insects are more numerous, and at the time of gathering the fruit, as the branches are disturbed, they have been reported as "flying up in clouds from the foliage."

With the appliances now at our command it should not be a difficult task to check and control the ravages of this pest. Its most vulnerable period is doubtless, as in the Aphididæ, at the hatching from the egg. At this time proper spraying with a kerosene emulsion will be fatal to it. If the spraying be deferred until the larvæ have become half-grown, the presence of the honey-dew would interfere with the action of the kerosene. Early spraying should also kill such of the eggs as may be reached by it, but many are placed in positions where they are almost entirely protected.

When the insect has passed to its winged stage, it has attained comparative immunity in the alertness with which it takes wing and leaves the tree upon the first motion communicated to the foliage by the impact of the spraying liquid. But even so late as this the war against the insect should not be abandoned, for multitudes may be destroyed, and the egg-crop for the following year greatly reduced. The kerosene emulsion will still be effective, but in its application all of the ordinary spraying-nozzles should be discarded, even the finest gauge of the Nixon nozzles, and a Vermorel used, adjusted to the delivery of the finest possible mist-like spray. With proper care the emulsion may be distributed over the entire foliage without scarce stirring a leaf and with the least possible alarm to the winged tenants. Of those that take wing — after circling about the tree for a while — on their return to the leaves, their bodies will in most cases come in contact with the liquid and cause their death.

Office of the State Entomologist, Albany, June 13.

THE TECHNICAL EDUCATION OF THE ELECTRICAL ENGINEER.[1]

BY DUGALD C. JACKSON.

PERHAPS it would be well to call my subject the "College Education of the Electrical Engineer," for it is strictly of the technical college course that I shall speak. We can truly affirm that the technical education of an engineer does not end until his work is ended, and the college course is but the commencement of it. That the college course can be made a very important fundamental part of this education, is becoming more thoroughly appreciated as the work of the technical schools comes into closer harmony with the demands of the profession, and it is now generally agreed that a technical college course, of the proper kind, forms a valuable aid towards the success of the average young man who wishes to enter the engineering professions. It therefore becomes a matter of no little moment to so arrange the course that its usefulness will be a maximum. A few years back, a college course entirely devoted to the training of electrical engineers was unknown. At the present time there is no dearth of such courses and their organization is progressing right and left, whence it is well to carefully consider what requirements of the electrical engineer's profession they may be made to meet, in order that no powder be wasted. It is neither possible nor desirable that the courses of study of electrical engineering students in the various schools should be alike, but a certain unity of purpose and treatment should be observed, and all can profit by the suggestions made by the practical man.

With this in view, I present the subject to your attention as it is looked upon at the Engineering School of the University of Wisconsin. There is no originality claimed for the ideas presented, as they are based upon the recorded experience of some of the country's most successful practical men, and are virtually followed in such other engineering schools as make their courses thoroughly practical, and therefore, in the true sense, professional. I trust, however, that a discussion will arise that is in proportion to the wide importance of the subject to the electrical profession, and that must result in a considerable increase in the efficiency of the electrical engineering courses in our various colleges, nearly all of which are still in process of crystallization.

In order to enter the freshmen class of the best engineering schools, the applicant must have a thorough common school education, including mathematics through ordinary algebra, a fair knowledge of English, a reading acquaintance with German or French, a little elementary physics and chemistry. This can be gained in the high schools of most of the cities of this country. The high school timber (some of it quite green) the college is required to work, and to work it to the best advantage requires no little careful designing. In order that an engineer may use his abilities and training most advantageously, he should have a good general education, including a fair knowledge of literature, history, economics and certain elements of law. This cannot be expected to come from the high school, and you can readily appreciate that an attempt to give a general education in an engineering course can only result in sacrificing the good of the students by omitting essential fundamentals. Thus, to have an average chance of proving successful, an electrical engineer must be well grounded in three sciences besides those gained in the common schools, and which can-

[1] A paper read at the General Meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6-8.