should be spelt—which is considered to connect the typical mammoth by means of *E. trogontherii* with the broad-plated *E. meridionalis* of the Val d'Arno and Forest-bed. Two molars from Tiraspol are stated to approximate respectively to those of *E. armeniacus* and *E. antiquus*, but it is scarcely likely that three more or less closely allied forms occur in one deposit. *E. trogontherii* is recorded from Nijni-Novgorod, *E. meridionalis* from Kowialnik, and the typical *primigenius* from a prehistoric station at Kievo-Kirillovskaïa. Finally, a molar from Tiraspol and a second from Bessarabia are respectively compared with those of the Siwalik *E. hysudricus* and *E. planifrons*.

The important part of Madam Pavlow's paper is, however, contained in the discussion as to the mutual relationships of the various species and races. After noting the resemblances between *hysudricus* and *meridionalis* on one hand and *antiquus* and *namadicus* (which some naturalists regard as inseparable) on the other, the author suggests that *meridionalis*, by an increase in the number and degree of compression of its molar plates, passed by means of *wüsti* and *trogontherii* into the mammoth, which died out without descendants. On the other hand, a thin-plated phase of the *meridionalis-hysudricus* group appears to have given rise to *antiquus* and *namadicus*, while the latter in turn produced the modern Indian elephant. The idea that *antiquus* was the ancestor of the living African elephant is considered improbable.

The main objection to these views appears to be the phylogenetic separation of the Indian elephant from the mammoth, the two being closely connected by the so-called *E. armeniacus*, which was probably the animal hunted by Thothmes III. in Mesopotamia. Moreover, the suggestion that *E. namadicus* (=*antiquus*) was the parent of the Indian species is unlikely on account of the peculiar form of the forehead in the extinct species. That the *meridionalis-hysudricus* line gave origin to the Indian elephant, and that the mammoth branched off from the same stock, perhaps, as Dr. Andrews has suggested, by way of *armeniacus*, is a far more probable supposition, and one that fits in with all the facts. In regard to the African elephant, there is a general tendency to connect it with *antiquus*, Dr. Andrews even going so far as to suggest ("Guide to Elephants in Brit. Mus.," p. 42) that the narrow-toothed form of the latter may have been the actual ancestor, or at all events nearly related to the ancestor, of the existing species, although in a previous passage (p. 39) he states that *antiquus* is unlikely to have given rise to descendants.

While venturing to dissent in some degree from her theoretical views, I may conclude by expressing appreciation of the value of the work of Madam Pavlow, as it is only by means of such investigations that we can hope to solve the riddle of the elephants. R. L.

WORK OF THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT IN 1910.

THE subjoined notes, based upon the annual report of the above institution for last year, indicate a few of the more important researches, &c., undertaken.

One of the chief researches was the joint work carried out at the Bureau of Standards, Washington, in conjunction with representatives of the English, French, and American standardising laboratories, the most important portion of this work being the determination of the value of the E.M.F. of the Weston normal cell. This was found to be 1·0183 international volts at 20° C. within limits of 1/10,000, agreement being secured in this respect among the countries mentioned. The value given has therefore been accepted in Germany as from January 1 last.

A research on the specific heat of gases at low temperatures by the continuous-flow method has been made. In using this method, a measured quantity of energy C^2R is conducted electrically to a gas passing through a tube at a constant rate of flow. If the temperature-difference *dt* between inflowing and outflowing gas is known when the stationary state has been attained, as also the quantity of gas Q flowing through the calorimeter in a certain interval of time, then $\frac{1}{J}\cdot\frac{C^2R}{Q\,dt}$ is the specific heat of the gas provided no thermal loss takes place, J being the mechanical equivalent of heat.

In the course of the ordinary conductivity tests on copper carried out during the last few years, it has been found that with great approximation proportionality exists between temperature coefficient and electrical conductivity, *i.e.* that a very approximate formula was $\alpha_{15}.c_{15}=\text{const.}$ (α_{15} temperature coefficient, c_{15} specific resistance in ohms m/mm^2 at 15° C.). The mean value for all types of copper tested at the Reichsanstalt since 1905, for the constant, is $6{\cdot}7_8{\cdot}10^{-5}$. The same relation seems to hold —of course, with other values for the constants—for aluminium and iron. A similar relation has been found by Dellinger at the American Bureau of Standards.

The investigation into the variation of wire resistances with atmospheric humidity has been continued, and further experiments made on coils hermetically sealed in accordance with the suggestion of the Bureau of Standards. Two coils were filled with petroleum and two with paraffin oil, and sealed up, measurements being made before and after sealing. The coils filled with paraffin oil have shown good constancy, while the petroleum-filled ones have not been so constant.

A comparison has been carried out between the German standard petroleum testers and four English testers, the result being that the flash-point as given by the English instruments is, on the average, 2° C. lower than with the German instruments, the same oil being used for both.

Some comparative tests have been made on Seger cones in the electric and the ceramic furnace, the results showing that the cones collapse in the ceramic furnace at much lower temperatures than in the electric furnace of the Reichsanstalt. A definite opinion as to the reason for this difference is not pronounced.

Investigations have been instituted into the change in length of hardened steel. The twenty sets of end rods, of 10, 25, 50, and 100 mm. length, forming the basis of the experiments, were again measured in November, 1910. The lengths of the great majority of test-pieces have become constant, four years after manufacture; the changes observed in the remainder are within small limits (fractions of a micron). The results are to be published shortly.

A series of tests have been made on the energy-loss in dielectrics. An experimental condenser was built up of ten plates of solid insulating material interleaved with copper-foil sheets, the capacity being from 0·004 to 0·01 mfd. A description of the method of testing is given, and the results up to now show that over a range of frequency 9 to 2000 periods the phase-variation in the case of some substances is only to a slight extent dependent on the frequency, while in the case of others the variation is considerable. Sometimes it was also noticed that the phase-difference depended on the voltage applied.

Numerous other researches more or less important in character were undertaken during the year, but space will not permit of describing them here. Those interested will find the report of the Reichsanstalt published in the *Zeitschrift für Instrumentenkunde* for April, May, and June.

E. S. HODGSON.

RECENT PUBLICATIONS OF ECONOMIC ENTOMOLOGY.

INSECT pests of trees and crops demand constant attention on the part of the expert, and a very voluminous literature is growing up round the subject. Few laboratories are more prolific in published papers than those of the Bureau of Entomology of the United States Department of Agriculture. Among recent papers, we note one by F. M. Webster on the alfalfa weevil (*Phytonomus murinus*, Fab.), a pest introduced from Europe or North Africa some six years ago, and now spreading somewhat widely in Utah, and another paper by the same author on the lesser clover-leaf weevil (*P. nigrirostris*, Fab.), an insect introduced probably fifty years ago, but not very common even yet; it suffers from at least two parasites, a small Tachinida and a fungus, *Empusa sphaerosperma*. The broad-nosed grain weevil (*Caulophilus latinasus*, Say) is described by F. H. Chittenden, and also the long-headed flour beetle (*Latheticus oryzae*, Waterh.); both are found in stored cereal products, and may become serious pests if they succeed in establishing themselves. Two other pests infesting stored cereal products are also described, the lesser grain-borer (*Rhizopertha dominica*, Fab.), which is fairly common, and is cosmopolitan in its distribution, and the larger grain-borer (*Dinoderus truncatus*, Horn), which is more confined to tropical countries. The ravages of the codling moth (*Carpocapsa pomonella*, L.) in California are dealt with by S. W. Foster; two full broods of larvæ could be traced during the season, the first, however, being relatively small, and often overlooked. Treatment with a lead arsenate spray is recommended. The grape leaf-hopper (*Typhlocyba comes,* Say) an insect causing damage to vines in the Lake Erie Valley, is shown by F. Johnson to yield to a nicotine spray. Three pests on crops are dealt with: the timothy stem-borer (*Mordellistena ustulata*, Lec.), a pest which has recently been observed by W. J. Phillips; the sorghum midge (*Contarinia sorghicola*, Coq.), described by W. H. Dean; and the maize billbug (*Sphenophorus maidis*, Chittn.), by E. O. G. Kelly. The alfalfa caterpillar (*Eurymus eurytheme*, Boisd.) is dealt with by V. L. Wildermuth; it is very common, and does a good deal of damage in various localities. A very useful bulletin by L. O. Howard sets out various remedies against mosquitoes. The best mixture for keeping them off was found to be 1 part of oil of citronella, 1 of spirit of camphor, and ½ of oil of cedar; a few drops sprinkled on a towel and hung over the bed will keep mosquitoes away during the night. For the actual bite the most satisfactory remedy is said to be moist soap. Traps are described, and methods for the destruction of the insects over both large and small areas are set out.

Hydrocyanic acid has long been recognised as one of the most potent fumigating agents, but great practical difficulties are met with in its use, which so far have not been entirely overcome. If the concentration of the acid is too high the tree is killed, if too low some of the insects escape; further, the optimum concentration depends somewhat on the conditions. Thus there is almost an indefinite field of work for entomologists, and a stream of bulletins is issued on this subject. Among recent issues from the United States Bureau of Entomology are two by R. S. Woglum and one by C. C. McDonnell.

The work of the West Indian Department of Agriculture is published in the West Indian Bulletin, but summaries are also given in *The Agricultural News*, the fortnightly organ of the Department. In vol. xi., No. 2, of the bulletin H. A. Ballou gives a list of the insect pests prevalent during 1909–10, a corresponding list of the fungoid pests being prepared by F. W. South. This is the first occasion on which information of this nature has been collected, and it is proposed to repeat the reports each year in order to obtain some records of the increase or decrease of any given pests, and thus to determine the effectiveness of the preventive measures used for control. The value of such a plan is obvious, and it might with advantage be adopted in our own country.

Considerable interest attaches to the control of insect pests by natural parasites, and we note that in Barbados the hymenopterous parasite *Zalophothrix mirum*, Craw., was able to keep in check the black scale insect (*Saissetia nigra*, Nietn.), whilst in St. Vincent it was not so effective. Simple instructions are given in issues of *The Agricultural News* showing how planters may introduce the parasite among the insects, and thus increase its action; in No. 232, in particular, a summary of the whole subject is given. Active search for parasites of other pests is in progress by other departments; investigators were, for instance, recently sent from the United States to Panama to search for parasites of the citrus white-fly (*Aleyrodes citri*), of the cotton boll-weevil, and allied species.

A well-illustrated bulletin has recently been issued by P. L. Guppy on the life-history and control of the cacao beetle (*Steinastoma depressum*, L.), which for some years past has been a serious pest and a source of trouble to planters in Trinidad. Hitherto nothing definite seems to have been worked out in regard to its life-history, and its habits have only been superficially observed. Mr. Guppy's publication supplies much useful information on the insect.

WATER SUPPLY.[1]

THE question of water supply is in one aspect a scientific one, and in another aspect a political one. The source of all water supply is evaporation, which raises and purifies water which is taken up from the land and the sea, which after condensation is returned to us as rain, dew, snow and hoar frost, and these waters are to be found ready to our hand in springs, streams, lakes, and in the envelope of earth which is tapped by means of wells. In early days the water supply was a matter of hand to mouth. In the matter of water, at any rate, men drank water when they were thirsty—unlike the characters in Maeterlinck's "Palace of Happiness," who had, you will remember, the Luxury of Drinking when they were not Thirsty and of Eating when they were not Hungry. In the old days people, in relation to these ordinary articles of diet, acted upon the advice given in that old-world book "Sandford and Merton," and "only drank when they were dry." Yet even in the old days men in this country used water occasionally for washing, although the modern passion for baths had not developed in the dark ages. We find, however, that even in these early days there was a political aspect in water supply. The existence of springs in many cases determined the sites of cities. Many towns have been built on rivers partly because they were sources of water supply, but mostly when the rivers were navigable and afforded a highway for ships. Now, however, it is found that populations have increased to such an extent in certain localities, owing to the gregariousness of men and other political considerations, that the immediate sources have proved inadequate, and great towns in this country—like Rome in ancient days—have had to go a distance for their water supplies, and have had to construct great engineering works for the conveyance of water to the area of distribution. Water is at present collected and sold in England to a value of nearly 8,000,000*l*. annually, and when it is delivered at the house of the consumer it costs him about 2*d*. a ton.

Aqueducts, or channels by which water is conveyed along an inclined plane, were known to the Greeks, but there are no remains of those they constructed. The Roman aqueducts were amongst the most important of their great works, and the present supply of Rome is still carried by these artificial rivers, sometimes through passages cut in the hills, sometimes on arches bridging the valleys and carrying the water across the plains. One of these aqueducts is 62 miles in length. We in this country have had to go even further afield for our water sources. A large portion (56 per cent.) of the supply of Liverpool is brought from the River Vyrnwy, in North Wales, a distance of 68 miles. Leicester is 60 miles from the sources of the Derwent Valley Water Board supply; Birmingham gets its water from Radnorshire, a distance of 74 miles; and Manchester from Thirlmere, by means of pipes and aqueducts, a distance of 96 miles. Paris derives some of its water from the Champagne district through pipes and aqueducts 80 miles in length, and some from Vanne, a distance of 104 miles. There has, too, been a suggestion that London should draw its public water supplies from Wales, which would involve carrying the water about 200 miles. This scheme was first suggested by Mr. Bateman in 1867. He proposed to collect the rainfall on 204 square miles, and, by means of an aqueduct 173 miles in length, to bring 230 million gallons of water a day to London, and he estimated the cost at 11,400,023*l*. About the same time, too, there was a suggestion to carry the water of Ullswater and Hawswater, which it was said could supply 550 million gallons a day from an area of 100 square miles to the metropolis, supplying Liverpool, Leeds, Bolton, Bury, Blackburn, Huddersfield, &c., on the way. These great ideas were, of course, too large to be realised in these small times, and many of these towns have, since the suggestion was made, supplied themselves with water by means of comparatively small scale works instead of becoming parties in a national undertaking.

The difficulty of meeting the demands of such large towns is obvious, from the fact that it involves such great works and such heavy expense to secure an adequate supply.

[1] From a discourse delivered at the Royal Institution on Friday, March 17, by J. H. Balfour Browne, K.C.