pedes, lizards, ants, scorpions, &c. Geological specimens were not numerous, but what there were were secured. A large number of specimens of shells and different varieties of coral were also collected.

The day following eclipse day, a Sunday, it rained steadily from morning until night. The camp became a hopeless morass; every tent was saturated through and through, and most of the contents as well. Fortunately, packing up had been commenced directly totality, of the day before, had finished, and by the evening the greater portion of all the instruments were safely housed away in their packing-cases in the instrument tent. Fortunately, again, I had had the floor of this tent covered with thick rafters to keep the cases off the ground, and if it had not been for this precaution the cases would have been thoroughly soaked. The rain therefore did little damage. We filled as many barrels as we had with the water from the awnings, and this came in extremely useful for the dark-room during the subsequent days spent in developing and making copies.

I had two special boxes made on board the ship to carry the original negatives, and the copies and one box will go home with the rest of the packing-cases, while the second will be dispatched later by a different steamer to England.

On May 3 the ss. *Tofua* arrived at Vavau on her way to Sydney, and I boarded her to inquire from her captain what he had seen of the eclipse. Captain Halford had stopped his ship right on the central line, and they viewed the eclipse in a cloudless sky. Several drawings which were made on board were shown to me, and they all indicate similar appearances, namely, equatorial extensions and rifts at both poles. Shadow bands were very conspicuous, and a great number of stars were logged. The captain kindly had a copy of his observations made for me, as I wished to compare the times of his contacts with those observed by us.

In the evening the *Tofua* left with all the eclipse parties except those going by the *Encounter*.

The next morning the *Encounter* weighed anchor from the spot where she had remained so long. I think we were all very glad to get away. If we had had a successful eclipse we might have severed our connection with a pang of regret. There were no regrets. We had worked hard and been treated very badly, and some of us, myself included, hoped we should never see the spot again. Out of the little harbour we steamed, stealing away before the inhabitants were up. One by one we passed the thickly tree-covered islands, and at last we came to the open sea and the cooler air, leaving the pests of flies and mosquitoes behind us. Oh those flies and mosquitoes; they were the curse of the island!

The *Encounter* being now bound for Suva, Fiji, to coal, and land Mr. McClean and myself, our course was shaped for that island. In order to make all land by daylight, a six hours' stop was indulged in off Late Island. This island is on the western outskirts of the Tonga group, and is nothing but a large volcano. With difficulty a landing was made, and while one party, including myself, started out to climb to the crater, another party went to shoot pigeon and pig. Incidentally, I made a good botanical collection, and gathered numerous specimens of seeds. On our return to the shore the tide had gone down, and the pools in the lava were full of the most beautiful coral fish and snakes, weird in colour and shape, that one could desire. An exciting return to the boats ended quite a successful day's adventure. The next day was spent at sea, and we sighted Suva on Saturday morning (May 6). Being "Accession" Day, the ship was dressed as the anchor was let go.

Mr. McClean, Mr. Anderson and myself took up our quarters at this port to await our ship, the t.s.s. *Marama*, which was to take us to Honolulu. On May 11 H.M.S. *Encounter* steamed gracefully out of the harbour on her way to Sydney, and it was sad to see her go without us, for both officers and men had become quite endeared to us. However, it had to be, and we watched her until nothing more than smoke was visible.

At Suva there was little to be done, as it was very hot, but there were no flies and very few mosquitoes, so we might have been worse off. On May 13 we drove to Rewa, a distance of twelve miles, and then took a motor-boat up the fine river Rewa, the upper reaches of which are very beautiful. To me this trip was disastrous, for next day I was laid up with fever. On May 15 our steamer, the *Marama*, bound for Honolulu and Vancouver, arrived, and we boarded her and sailed the same evening. At the moment of writing (May 21) we are now two days off our destination, and we are indulging in the cool N.E. trades after the stillness of the doldrums.

After Honolulu we are bound for the States, where I hope to see first hand the chief American astronomical observatories. We are due in England about July 11, when we shall have completed a most interesting circuit of the earth. We shall have gained one day!

W. J. S. LOCKYER.

A NEW ROD OF AARON.

THE naturalist and the physiologist have been well acquainted for several years with the results achieved by Loeb, Delage and others, in the way of causing the eggs of various animals to develop by chemical and other purely physical means, apart altogether from the agency, direct or indirect, of the male animal; but these astonishing experiments are still very little known to workers in other sciences. Before directing attention, as is the object of this short note, to the last and perhaps the most startling of all such experiments, it may be worth while to say a few words on the general question.

The subject seems to fall under two heads, namely, artificial means of facilitating the action, or of widening the sphere of action, of the male element, and, secondly, means of dispensing with it altogether and of replacing it by some wholly artificial stimulus.

In Loeb's early experiments he showed that, while under normal conditions the eggs, for instance, of a sea-urchin could not be cross-fertilised by the sperm of a starfish, yet by simply rendering the surrounding sea water faintly alkaline, a new condition was established in which the sea-urchin's eggs were capable of fertilisation by the sperm-cells of any or every species of starfish, and by certain other alien species of echinoderms besides, while, at the same time, in this more alkaline sea water the sperm of the original sea-urchin had actually lost the power of fertilising the eggs of its own species.

More than five-and-twenty years ago it had been shown, by Tichomiroff and others, that the eggs of the silkworm could be caused to develop "parthenogenetically" by simple mechanical stimulation, such as brushing, or by chemical treatment, as with sulphuric acid. But these results attracted less notice than they should have done, partly, perhaps, because in other insects parthenogenesis, or the development of unfertilised eggs, was known to occur under natural conditions, as in the case of green-flies or plant-lice (Aphides), or in the case of the drone-progeny of the queen-bee.

Passing over various intermediate experiments, we come to those which Loeb published in 1904, in which he showed that, if the eggs of a sea-urchin be put into sea water to which has been added a little formic, acetic, butyric, or other fatty acid, and then after a minute or two be put back into ordinary sea water, they begin to show the initial changes characteristic of nuclear division. But if, on the other hand, they be transferred from the acidified sea water to sea water the concentration of which is increased by a suitable addition of common salt, then the whole cycle of development proceeds just as though normal fertilisation had taken place, and the highly complicated free-swimming larvæ are produced in unlimited numbers and in the same manner and at the same rate as in the ordinary course of sexual development; and if the experiment has not been carried further, to the complete post-larval development of the entire sea-urchin, it must be remembered that the artificial feeding and rearing of this and other marine animals beyond a certain stage, even from normal and fertilised eggs, is a matter of the very greatest difficulty. Precisely similar experiments have been successfully performed by various workers on marine worms and molluscs, and a few years ago Bataillon showed that even the eggs of the lamprey could be induced to segment by simply placing them in water of a certain

degree of salinity. It is impossible to discuss here the various theories of fertilisation to which these astonishing experiments have given rise.

But such phenomena appear, perhaps unreasonably, all the more astounding to us, as the animals experimented on are higher in the scale; and so we may look with renewed wonderment at a phenomenon which M. Bataillon has demonstrated in the frog, and M. Henneguy has repeated and confirmed.[1] Eggs were taken from the body of a female frog, under proper antiseptic precautions and with careful simultaneous "control" experiments. The eggs were placed in a little dish, and were then carefully pricked with a tiny needle of platinum or a sharp spicule of glass, after which they were covered with a layer of water sterilised by heat. In the hands of these physiologists, the little needle was as potent (or almost as potent) as Aaron's Rod. In about four hours the eggs began to develop, but while all of them passed through some initial stages, it was about one-fifth only that segmented in the normal way. At every stage the mortality was greater than in the case of ordinary fertilised eggs, but at length, out of a thousand eggs experimented on, one hundred and twenty hatched into tadpoles, and of these three were reared through parts of their metamorphosis. They did not actually turn into frogs, but died accidentally or for want of proper nourishment after the appearance of their legs, and after the oldest (about three months old) had all its four legs well developed and its tail already beginning to disappear; it was, in short, all but a perfect frog. As with St. Denis, when he walked a short distance with his head under his arm, "ce n'est que le premier pas qui coûte"; but these tadpoles, if they did not endure to the end, went a long distance on their way.

It is all but superfluous to add that the authors of these researches are men of high standing and reputation, skilled in all the precautions necessary for the carrying out of their experiments and for safeguarding them from all sources of accidental error. In short, we may have no doubt at all that what they assert they have actually performed—that they have demonstrated the artificial fertilisation of a vertebrate ovum by a simple mechanical stimulus, and that, so to speak, they have raised a hybrid between a needle and a frog! But here we are face to face with the double *rôle* which the male plays in the process of fertilisation, for, on one hand, it is his part to give the initial impulse or stimulus to the act of development, and on the other to convey to the offspring a share of his own hereditary qualities or characteristics. In these artificial experiments of parthenogenesis the two influences are dissociated. The former one is efficiently replaced by chemical or mechanical means, but the other drops out of sight altogether. For, as a French critic has remarked, "il ne peut être question d'hérédité du côté du père, car on ne voit pas très bien les jeunes grenouilles héritant des propriétés de leur épingle paternelle"!

D. W. T.

AGRICULTURAL RESEARCH IN CEYLON.[2]

THE staff of the Royal Botanic Gardens, Ceylon, show commendable activity in investigating the planters' problems that come under their notice. At frequent intervals issues are made of the Circulars and Agricultural Journal containing their papers, which will be found to bear comparison with any publications from other experiment stations. These papers show an obvious mastery of the situation, they are conceived in a scientific spirit, and exhibit none of the looseness characteristic of amateur investigations into agricultural questions. Tea and rubber naturally come in for a good share of attention, but other crops also present their problems, many of them of considerable interest and importance.

As usual in subtropical countries, most of the problems are connected with insect and fungoid pests, and half of the present batch of publications are from the mycologist, Mr. T. Petch. Five root diseases of tea caused by fungi are described. The commonest is caused by *Ustulina zonata*, Lév.; the dead tea roots show no external mycelium, but only a few inconspicuous black spots; if the cortex is removed, however, white fan-shaped patches of mycelium are found overlying the wood. The starting points of the disease are usually the dead stumps of Grevillea, which is grown among tea, and cut down either for firewood or when it has grown too large. Another common disease is caused by *Hymenochaete noxia*, Berk., a fungus that attacks numerous other plants. Here the mycelium is external to the root, and binds up a mass of sand, earth, and small stones, thus forming a crust 3 or 4 mm. thick; in the early stages the mycelium is brown, whence the name brown root disease has been given; later on, however, the whole turns black. It is the commonest root disease of Hevea in Ceylon, but does less damage than *Fomes semitostus*; unlike the latter, it does not spread through the soil, but only along the roots of trees; hence its progress is so slow that, as a rule, the first affected tree is dead before the neighbouring trees are attacked. Another root disease of Hevea, so far uncommon, is also described. It is caused by *Sphaerostilbe repens*, B. and Br., and is characterised by the black or red flattened strands running over the surface of the wood after the cortex is removed, there being no external mycelium. *Acacia decurrens*, which has been extensively planted as a wind-break for tea or for green manuring, and for more than thirty years seemed immune from disease, has now been found to suffer from two root diseases in addition to a "gummosis," the cause of which is not yet ascertained. An agaric, *Armillaria fuscipes*, causes one root disease, and *Fomes australis* the other. Another publication deals with canker in cacao and hevea. The latter plant does not usually suffer from canker when grown alone, but it is badly affected when grown in mixed plantations with cacao, which serves as a permanent source of infection. It is concluded that both canker and pod diseases are caused by *Phytophthora faberi*, Maubl.; complete examination was, however, made of the other fungi also present.

Mr. E. E. Green describes the extraordinary outbreak of snails, *Achatina fulica*, that has occurred in part of the island, and to which reference has already been made in these columns. This snail is large, its shell being about 4½ inches long, and weighs about 4 oz. It has only recently been introduced, but it has not effected nearly so much damage as might have been expected, because it feeds on human and cattle excreta; indeed, Mr. Green considers that, on the whole, it is doing more good than harm, and does not recommend any drastic attempts at extermination. Before long the natural enemies will keep it down.

Messrs. Kelway, Bamber, and R. H. Lock give a preliminary account of their studies on the effect of different intervals between successive tappings in Para rubber. A previous investigator, Parkin, obtained an increase of more than 600 per cent. of latex by increasing the frequency of tapping; Bamber and Lock, on the other hand, find no such marked wound response, although they advise frequent tappings from the practical point of view.

The official correspondence with regard to cotton-growing in Ceylon is also published. Dr. Willis does not think there is much future for the crop; other products yielding larger profits are not likely to be displaced. There is also a useful account of various samples of Cymbopogon grass oils prepared by Mr. Jowitt, of Bandarawela, and examined at the Imperial Institute.

ABSORPTION SPECTRA OF METALLIC SALTS.[1]

THE present volume is designed as a continuation of the work of Jones and Uhler and Jones and Anderson, and gives the results of a detailed study of the absorption spectra of salts of potassium, cobalt, nickel, copper, chromium, erbium, praseodymium, neodymium, and uranium, as affected by various chemical reagents and different temperatures. For the purpose of the discussion some 3000 solutions have been examined. The main points

[1] "L'embryogénèse complète provoquée chez les Amphibiens par piqûre de l'œuf vierge," etc. Par E. Bataillon. C.R., Avril 13, 1910; Arch. de Zool. exp. et gén. (5), vi, Nov. 1910; C.R., 27 Mars, 1911.
"Sur la parthénogénèse expérimentale chez les Amphibiens." Par F. Henneguy. C.R., Avril 3, 1911.

[2] Circulars and Agricultural Journal of the Royal Botanic Gardens, Ceylon. Vol. v.

[1] "A Study of Absorption Spectra." By H. C. Jones and W. W. Strong. Pp. ix+159+98 plates. (Washington, D.C.: The Carnegie Institution, 1910.