scattered over a difficult mountainous region. Of these forests, the State possesses 54,000 acres, and 27,000 acres are in a territory assigned to the indigenous inhabitants of the country. The Government has decided that in the mountains the action of the Forest Department will be restricted to the State forests. They contain many species; *Podocarpus Thunbergii* and *P. elongata*, both known as yellow-wood, are the commonest, and their wood resembles that of the European spruce. At present the great cost of transport prevents the profitable working of yellow-wood. Amongst the remaining species, the two most valuable trees are stink-wood (*Ocotea bullata*), so named on account of the bad odour of freshly-sawn wood, an evergreen lauraceous species with a beautiful brown heart-wood, which is hard and tough; and sneeze-wood, *Pteroxylon utile*, an ally of the horse-chestnut. These woods are also highly esteemed in the Cape Colony, especially for cart and wagon making, and can be worked at a profit even from these remote mountain forests. Unfortunately these two species are only found here and there in the forests, and there is no large supply of them.

In the year 1891-92, the sale of wood by the Natal Forest Department yielded £725, while the expenditure was £1942, partly for establishment and partly for the survey of the forests. Owing to the small area of forests available, and the remote position of the State forests, Mr. Fourcade strongly recommended that plantations should be started near the towns and railways. Past experience with the blue gum (*Eucalyptus globulus*) is favourable for the success of this tree in Natal. At Arambi, near Ootacamund in the Nilgeri Hills in India, this tree attains a height of 107 feet in nineteen years, and yields 8696 cubic feet per acre. This enormous production of 457 cubic feet per acre annually was attained in latitude 11° N. at an altitude of 7426 feet above sea-level.

In the higher latitude of Natal, a similar climate to that of Arambi is found at 2275 feet above sea-level, and, according to Mr. Fourcade, mixtures of *Eucalyptus globulus*, *longifolia* and *rostrata* give an even higher yield near Maritzburg than at Arambi. Mr. Schöpflin doubts whether this will be the case; but, at any rate, the gum-trees will give a large yield, and if the wood were only fit for fuel a considerable pecuniary return would be obtained. Several of the gum-trees, however, yield splendid timber, and especially *E. rostrata*, the red gum of Southern Australia.

Timber imports into Natal average in value £180,000 a year, so that, as the indigenous forests are small, much subdivided, and unfavourably situated, the State is clearly called upon to plant up a sufficient area of the State lands. Mr. Fourcade states that the land necessary for these plantations can now be purchased cheaply, and Mr. Schöpflin commenced planting operations. This useful measure is now abandoned, owing to want of funds, and the plants in the State nurseries will be sold.

Besides *Eucalypti*, several Australian acacias succeed admirably in Natal, especially *A. decurreus* and *mollissima*; their bark is rich in tannin, and a plantation of 1200–1500 acres of these trees has been started by a private company. Near the neighbouring Transvaal gold-fields, Australian trees are being planted on a large scale to supply mine-props.

The length of rails in Natal is about 625 miles, and the mountain forests will yield a portion of the necessary railway sleepers. Yellow-wood must be kyanised, as has been done in the Cape Colony, and kyanising works can easily be established in Natal, and wood from gum-tree plantations ought to supply the balance of the sleepers required.

It is evident that Natal cannot possibly prosper without a Forest Department, and the colony will have cause to regret having abandoned the attempt to form one, after such an excellent beginning has been made. The Government wished to retain Mr. Schöpflin's services up to March 31, 1894, but would not undertake to employ him after that date. Under these circumstances, he was obliged to resign his appointment last September, in order to return to the Baden Forest Service.

W. R. FISHER.

THE FERTILISATION OF "LORANTHUS KRAUSSIANUS" AND "L. DREGEI."

THE parasite *Loranthus Kraussianus* grows on the coast here on the tree *Chætacme Meyeri*, and as three of these trees grow within a short distance of my house, I have this season had a good opportunity of observing the rather curious mode of its fertilisation. In the flower bud the corolla segments adhere along their whole length, forming an upright cylinder, of about an inch long, of red and white, thus getting the not inappropriate colonial name of "lighted candles." The flowers grow in close umbels, so close together as to give quite a reddish tinge to the host tree. After a little time five slits appear about half-way up the upright cylindrical corolla, and these slits are about one quarter the length of the cylinder. The anthers occupy *almost* the extreme tip of the cylinder, and are pressed against each other by the closed tube of the corolla (the cylinder aforesaid), the actual tip being occupied by the capitate stigma. If a needle be inserted into one of the slits of the corolla with a downward movement, as if to seek the nectar at the base, it causes the tube to split with some force, and at the same time the anthers are quickly and forcibly released from their pressure one against the other, and fly downwards violently, scattering practically all the pollen they contain by the one movement; and at the same time the stigma, from being upright, springs to an angle of, say, 40 degrees on one side quite clear of the now split corolla tube. I found by microscopic observations of a number of stigmas just at this stage, that only in a small proportion of cases (I only found one) did any of the triangular pollen actually reach the stigma by the act of explosion, although the style was fairly thickly peppered. These flowers are constantly being visited by large numbers of the commonest coast sunbird (*Cinnyris olivaceous*), a very active and hard-working, though not very brightly coloured, member of the sunbirds. A little quiet watching will show the birds at these flowers splitting open flower after flower, and getting head and bill covered with pollen in moving about, undoubtedly fertilising the capitate receptive stigmas (in the receptive stage protruding free from the corolla tube) of other and older flowers. After seeing them thus at work, the question arose whether without their aid the bursting of the flower happened. The negative evidence was that although I had observed for many hours, I never saw a simple flower voluntarily explode; but to check this, I put a net-bag over a small branch containing, say, 80 to 100 healthy flowers. I found that when thus protected hardly a single flower got to a further stage than having the splits on the corolla tube ready for the outside aid of the sunbird to enable them to perform the next function, viz. explosion. Actually none exploded, and, as a consequence, not a single flower within the bag set seed. They seem to be quite sterile without outside help, the anthers dehisce, but at a level below the capitate stigma, and as the corolla tube is generally upright the pollen is lost even as a self-fertilising agent. After careful watching, I feel sure sunbirds are the only effective agents in the fertilisation of this plant. At first I never observed bees visiting it, and actually made a note to the effect that they did not do so; but at a later date they came in good numbers. They seemed simply to follow the birds, and take any nectar left by them in the exploded flowers, and very seldom, and then, I think, only by a happy chance themselves caused the explosion. I did not observe any other insect visitors, so that it would appear this plant is dependent on *Cinnyris*; and there is an element of irony in it, for from the berries of this plant the boys make bird-lime, and the energetic efforts of these lovely little birds are towards the perpetuation of the means by which they are often made captive. It would be interesting to know how far the different individuals of *Loranthus* on the one tree are in the position of independent individuals of terrestrial species (pollen from an *independent individual* being necessary for the most perfect results of cross-fertilisation), or whether the fact of having a common host approximates them in this respect to the position of one plant, and whether to get the best results of cross-fertilisation pollen should be brought not from flowers of a different individual on the same host, but from plants growing on a different tree altogether. To carry on the life-history of this plant, my friend Mr. Harry Millar, of Durban, informs me that the berries when ripe are taken by the little tinker bird (*Barbetula pusilla*), who eats the *covering* of the berry, and rejects the seeds and viscid matter around them, and to clear away the latter bangs the berry with his bill against a tree, where the seeds adhere with the viscid substance and germinate. I may say that Mr. Millar states that in shooting these birds, as specimens, he often finds the head and bill covered with pollen. I am informed that another sunbird (*Cinnyris Verreauxi*) visits this plant, but as it is of the same habits as *C. olivaceous*, the results of its visits, as far as the plant is concerned, would be the same.

Loranthus Dregei grows on the coastlands of Natal upon various hosts, most commonly perhaps upon the introduced Syringa, *Melia Azedarach*, and never, so far as I have observed, upon the tree (*Chætacme Meyerii*) infested by *L. Kraussianus*. While in the bud the petals form a cylindrical tube, and the anthers are pressed against the closed petals, the tips being just below the stigma. Subsequently slits appear on the still closed cylinder. My observations show that the plant is abundantly visited by *Cinnyris olivaceus* and *C. Verreauxi* and that both birds insert their long bills into the slit to get at nectar secreted at base of tube, exactly as in *L. Kraussianus*. In this species, however, instead of the anthers remaining still attached to the filaments when the flower jerks open, they are all broken sharp off, and fly off into space with great violence, parting with their pollen as they go. I find that although the pollen is thrown so far upwards as to reach the base of the stigma, the force appears so nicely adjusted that none actually reaches it, the great bulk of the cloud of pollen being thrown downwards so as to reach the head and beak of the visiting bird. Apparently after this dissemination of its pollen (and anthers) the flower still has attractions for the sunbirds, for I have seen them distinctly visiting the burst flowers, and this would of course be necessary if cross-fertiiisation or, indeed, fertilisation of any kind took place. And on opening the burst flowers I found in most cases a quantity of nectar, so that probably secretion goes on after the flower is open and its anthers gone. I observed this plant repeatedly and at all hours of the day, and never saw it visited by a single insect of any kind; and although aware that negative evidence of this kind cannot be relied upon, my observations were so frequent that I feel sure any insect visitants, at all events diurnal visitors, must be exceedingly rare. I noticed one flowering upon *Acacia* sp. which was also in flower and visited by bees, but the bees took not the slightest notice of the flowers of the *L. Dregei*. I should judge from the length of the corolla tube, that if any insect visits this plant, it must be furnished with a long proboscis, for the flower tube from stigma to base is fully two inches long. As in *L. Kraussianus* the flowers need outside aid to burst at all, for I have watched them for long periods and in all kinds of weather, and never seen a single flower burst by its own volition. Although apparently entirely dependent on the sunbirds for its propagation, this mode of fertilisation must be very successful, for the plant is very common indeed. In addition to the fact of the flying pollen never reaching the stigma, and self-fertilisation being thus prevented, the flower seems to be proterandrous, for at a stage of development when a slight touch in the right place bursts the flower, the stigma seemed dry and unreceptive. After bursting, the stigma, instead of being in line with the corolla tube, inclines to one side, though not to such an extreme angle as in *L. Kraussianus*, and this deviation from the upright will help pollination to some extent. I have often watched the birds on these flowers bursting them, and each time causing quite a little cloud of pollen and anthers to fly, and the force is so great, the anthers are jerked to quite a considerable distance, and in no single instance did the force fail to detach the whole of them. It is a very pretty and interesting sight. In the case of this species, I believe it is absolutely dependent on the sunbirds for its sexual propagation.

Durban, Natal. MAURICE S. EVANS.

SCIENTIFIC INVESTIGATION IN CANADA.[1]

IN a Society formed to include as far as possible representatives of all branches of literature and of science, it appears to be most appropriate that the president for the time being should devote the address which it is his privilege to deliver, to some specific topic, or to the consideration of such matters of interest or importance as may lie particularly in his own line of work or thought. The literary, artistic, and political development of the country have already been dealt with. It may therefore be of some interest and service to give a very general and very brief review of what has been accomplished, and what remains to be accomplished in Canada, by various scientific agencies working in the investigation of the natural features, and towards the development of the natural resources, of the country.

Science is but another and a convenient name for organised knowledge, and as such it has entered so largely into every branch of human effort, that when, at the present time, any one attempts to pose as a "practical," in contradistinction to a scientific worker, he may be known to be a relic of the past age, in which much was done by rule of thumb and without any real knowledge of the principles involved. Neither can any division be made between what is sometimes called "practical" or "applied" science and science in general, for the knowledge must be gained before it can be applied, and it is scarcely yet possible to bar any avenue of research with a placard of "no thoroughfare," as an assurance that it cannot lead to any material useful end.

At the same time, there are certain directions in which investigation is very closely wedded to results of immediate and tangible value. But the line should not be too rigorously drawn, for should the investigator for a time stray into some by-path of research, because of his individual interest in his work, it is not improbable that he may return from his excursion with some unexpected discovery, which may prove to have important bearings on the problems of every-day life. Take, for example, the study of palæontology, which, relating as it does, to extinct forms of life, might appear to be a branch of science wholly removed from any practical object, however interesting it may be to disinter and to reconstruct these remarkable forms. But we all know that this study has become an indispensable one as an aid to the classification of the rock formations, and thus to the search for the useful minerals which some of these contain. This is more particularly the case, perhaps, in the instance of coal beds, which are usually confined in each region to some set of strata, which may be defined with precision only by the aid of the evidence afforded by fossil remains.

THE GEOLOGICAL SURVEY.

In the first united Parliament of Upper and Lower Canada, in 1841, the Natural History Society of Montreal and the Historical Society of Quebec joined in urging the establishment of a Geological Survey upon the Government, with the result that the modest sum of £1,500 sterling was granted for the purpose of beginning such a survey.

Mr. Logan, afterwards so well known as Sir William Logan, was the first geologist appointed. He entered upon his duties, in 1843, with the greatest possible zeal, and for more than twenty-five years the history of the Survey and that of its director were the same.

The field work of the Geological Survey necessarily began with exploratory trips in which the main features to be dealt with, in a country almost entirely unknown geologically, were ascertained. In many parts, even of the older provinces, such explorations are still requisite, but in most of these provinces it became possible after a time to proceed with the more systematic mapping of definite areas, the map-sheets produced forming parts of a connected whole. When the great western regions were added to the field, these could only be attacked by extended exploratory journeys in which geology and geography went hand in hand. As it is now, the field work of the Survey may be divided under three classes: (1) Reconnaissance surveys; (2) the approximate mapping of large areas on a small scale; (3) finished map-sheets on a larger scale, and forming continuous series. All these three classes of work are in progress concurrently in different districts, while the auxiliary chemical, palæontological, and lithological investigations in the office are kept in touch with the field work, and render it possible to bring this together in a homogeneous form. Were there in existence any complete topographical maps of Canada, approaching in accuracy to those which have been made in older countries, much more geological work could be accomplished with a given amount of money and in a given time, and thus the construction of such maps must be stated yet to be, as it has been from the beginning of the Survey, one of the principal desiderata. There is, however, one other matter which at the present moment must be regarded as even more urgent, and one which might be attained within a short time and at a relatively small cost. This is the construction of a suitable and safe museum building for the preservation and display of the important collection which has grown up as the result of so many years of investigation. This collection is not merely a matter of record, closely connected with all the publications of the Survey, but it is fitted to become also a great educational medium in regard to the mineral resources of the country. With proper accommodation its utility could be vastly increased for all purposes.

[1] Abstract of an address delivered before the Royal Society of Canada, by Dr. G. M. Dawson, C.M.G., F.R.S.