

render female education more popular and effective, and on their success the future progress of India in a large measure depends.

It is remarked that during the five years a very great change has taken place in the feeling of the population of India towards education, and it is now much more popular than it was. Indeed there was a proposal to make primary education compulsory in India generally, but this has been negated, though it is being adopted in Baroda.

Much more money is now being spent on education. In 1907 the cost of education was said to be 559 lakhs of rupees, and in 1912 it had risen to 786 lakhs, of which the Government contributed a very large proportion. With this liberal policy there is no doubt very rapid progress will be made, for the cost of educating individual pupils in India is still small. Thus the annual cost of a primary-school pupil is about six shillings, of a secondary-school pupil about 1*l.* 12*s.*, and of a pupil reading for a university degree about 1*l.* 5*s.*, and yet with these small individual sums a fair training is being given in the case of university and secondary education, though the primary education is still very defective.

#### THE MOUNT WILSON SOLAR OBSERVATORY.

IT is always difficult to condense in a few lines the essence of the work accomplished during a year at the Mount Wilson Solar Observatory. The report for the past year, just issued by the director, is a concentrated essence by itself, and as it covers forty-five pages the difficulty of the task will at once be grasped. The director commences the report by summarising the principal results obtained during the year, and the brief paragraphs which compose this summary, each of which is practically restricted to an important piece of research work, number no fewer than *seventy-two*. Space does not permit one to refer even to the more important of these, but many have already received notice from time to time in our astronomical column, and are therefore familiar to our astronomical readers. Perhaps the most important result is that concerning the magnetism of the sun. Observations of the Zeeman effect at various solar latitudes have indicated that the sun is a magnet, and that the magnetic poles are at or near the poles of rotation. Further, the polarity of the sun corresponds with that of the earth, a conclusion, as the director, Prof. Hale, remarks, which may prove to have an important bearing on theories of terrestrial magnetism. The first approximate value for the vertical intensity of the sun's general field at the poles is given as 50 gauss, which is about one-hundredth of the intensity of the most powerful sun-spot fields, and about eighty times that of the earth's field.

One of the most interesting items usually associated with these reports is the work of construction in hand, and this report shows an astonishing amount of work in progress. The fact that the 100-in. disc has been proved to be serviceable for a reflecting telescope has given rise to a great increase of activity. The grinding of the mirror and the 60-in. plane mirror for testing it have been pressed forward, and the requirement for larger shop tools necessitated by the construction of many parts of the 100-in. telescope mounting and the auxiliary instruments to be used with it have even demanded an increase in the already large shop floor-space. The work involved in the preparation of the foundations for this telescope and of the building and the eventual transport of the instrument to the moun-

tain-top has necessitated the adoption of especially powerful motor trucks in place of the mule teams.

Other important work in hand is the construction of a large ruling-machine, embodying the general principles of Rowland's successful ruling-machines. An idea of the accuracy attained after the grinding and polishing of the screw will be gathered from the statement that no periodic errors were found greater than 0.000001 in., and no appreciable error of run could be detected. The maximum error in the teeth of the wormgear did not exceed 0.001 in., a quantity too small to produce appreciable ghosts.

To gain a more complete insight into the contents of the report the reader must be referred to the report itself. The fact that such rapid advances are being made in both solar and stellar physics is due to the happy combination of an energetic and able director, a keen and active staff, a good observing site, and an annual grant (for 1913) of 33,126*l.* for construction, investigations and maintenance.

#### MARINE INVESTIGATIONS.

THE report on the Danish Oceanographical Expeditions, 1908-10, to the Mediterranean and Adjacent Seas, under the superintendence of Johs. Schmidt, No. 2, contains two memoirs, one by Dr. Kyle, on flat fishes, and one by Dr. Schmidt, on experiments with drift-bottles. Dr. Kyle's paper is an important contribution, and deals with the following genera in a very comprehensive way:—*Arnoglossus*, *Bothus*, *Solea*, and *Symphurus*. The much disputed question as to the number of species of *Arnoglossus* occurring in European seas is very elaborately discussed, and Dr. Kyle's conclusions differ in several respects from those of previous authors. He recognises five species, the specific names being used, however, in a different sense from that which has been adopted by recent writers on the subject. The species are *Arnoglossus grohmanni*, Bonap., non auctorum, *A. thori*, nov. nom., *A. laterna*, Will., *A. imperialis*, Raf., and *A. rüppelli*, Cocco. Of these *A. thori* is the species which has generally been called in this country *A. grohmanni*. Dr. Kyle discusses not only the adult characters, but also the larval and post-larval stages of this genus and of the other genera of which he treats. The paper is well illustrated with text figures and plates, and will be of the greatest value to future workers. An excellent bibliography of the subject is added. Dr. Schmidt's experiments with drift-bottles show that there is an easterly drift of the surface water from the entrance of the Mediterranean, especially along the north coast of Africa, so that water from the Atlantic is being constantly carried into the Mediterranean. The velocity of this drift may reach eighteen to twenty miles a day.

The Central Bureau of the International Council for the Study of the Sea has issued vol. xvii. A of the "Rapports et Procès-verbaux des Réunions" (English edition), which contains the first part of Prof. Heincke's long-delayed general report upon the investigations on the plaice. This part of the report is confined almost exclusively to a discussion of the statistics obtained from commercial fishing vessels, and is further limited in scope by the fact that the English statistics are alone considered. The report is, in fact, little more than a renewed attempt to discuss the conclusions to be derived from these English statistics, matters which had already been dealt with by the officers of the Board of Agriculture and Fisheries. It is doubtful whether Prof. Heincke's methods of dealing with the statistics are in any way an improvement upon those followed in this country, and, probably from want of adequate trained assistance, it seems clear that the work has not been car-

<sup>1</sup> Annual report of the director of the Mount Wilson Solar Observatory 1913. Carnegie Institution of Washington.