Such records have been made for more than thirty years in France and Germany, and surely we must have here, if anywhere, a sufficient proof of a forest's influence.

Admitting that we have perfect instruments and careful observers, there still remains a most serious doubt as to the immediate environment of each gauge and as to the possibility of a direct comparison. It is probable that no two gauges 2000 feet apart can be placed so as to catch the same amount of rain, though to all appearances the exposure is faultless in each case.

Extreme caution is therefore needed in arriving at conclusions from comparisons between gauges in forests and in the open. One of the best of all researches in this line has been conducted at Nancy, in France. Within a distance of five or six miles there have been four stations established. At Nancy in the open, and at Belle-Fontaine in the forest; and, 500 feet higher vertically, Amance (open) and Cinq-Tranchées (forest). At Nancy and Belle-Fontaine the observations extend over twenty-five years. A comparison of the records in groups of eight, eight, and nine years was made, with the result that while the first eight years showed a very slight excess in the forest rainfall over that in the open field, in the last nine years (including 1894, last published) the open station showed a little more rain than the forest station. These observations were made with particular care, for the purpose of exactly determining the influence, and may be relied on if the environments of the gauges were comparable. At Amance (open) and Cinq-Tranchées (forest) the observations have not been quite so regular, though there are twenty-five full years of records at these two stations, but not the same years as at the other stations. The comparison in this case makes the rainfall more than 20 per cent. greater in the forest than in the open. It should be borne in mind, however, that these two stations are on an eminence, and are not strictly comparable, and this result cannot vitiate that at the two other stations, which shows no effect.

In Germany we have a rather remarkable record of a slightly different character. Lintzel is a station on the Luneburg Heath, which began to be planted with trees in 1887, at the rate of 1000 to 1500 acres a year, and in a few years over 8000 acres were covered. In the midst of this forest is the meteorologic station in an open field of some seventy-five acres. Before planting the forest, 97 per cent. of the surface was field, meadow, or heath, and afterwards 80 per cent. was forest and 20 per cent. was roads, open field, and heath. Around this station, pretty evenly distributed, and within fifty miles, there are thirteen rainfall stations which have been carefully established, and presumably are comparable with the Lintzel station in the midst of the growing forest. There are no means of knowing whether any of these stations have been changed or not, but for our purpose we may consider the material homogeneous, and treat it accordingly. Records from 1882 to 1896 (fifteen years) are available. Charts were prepared for each year showing the ratio between the Lintzel record and that at each station of the thirteen. The results do not show that the afforestation has had any appreciable effect upon the precipitation; in 1884 the ratio was 101, while in 1893, nine years later, it was 96. It is probable, however, that no definite and unassailable result can ever be obtained either by the method adopted in France or this later one in Germany. The rainfall is so variable within a distance of even a mile or two; and it is so difficult, if not impossible, to obtain similar environments at all the stations, that no decisive result can be obtained. It will be readily seen that the multiplication of stations will do no good, and, above all, that the observation of rainfall under trees in a forest is absolutely useless for any such discussion or study as this.

Need of Further Evidence.

It seems probable that if two or three lines of stations could be established a mile or two apart on four sides of an enormous forest, each line to have a dozen stations or so, about 3000 feet apart, four of the stations to be outside of the forest, and the others each in a large cleared space of at least two acres extent in the forest, something decisive might be obtained. It should be noted, however, that from the evidence already accumulated there would be very little to be gained by a further study of the question. It is certain that the effect, if there be one, is almost inappreciable. The favouring conditions over the forest are balanced by those not favouring, and the integrated effect is practically the same in the two cases.

Prof. H. F. Blanford determined from a most careful series of records, from which all known errors had been eliminated, that the forest had a tendency to give 2 per cent. more rain than contiguous open fields. That is, if an open place had 50 inches of rain in a year, a near-by forest would have only 51 inches, which is practically inappreciable.

It would be an interesting study to select all those cases in experiments in forest and near-by fields in which the wind was blowing either from the forest to the field, or *vice versâ*. It is evident that if there is any effect on rainfall by the forest, it would be vitiated, if not exactly reversed by such winds.

There is a class of visual observations which seem to show an effect upon rainfall by the forest. Probably many have seen heavy clouds passing over a plain, but which only precipitated as they passed over a forest. Also in a hilly region it is a frequent phenomenon that fog and low-lying cloud hover near a forest, and not over an open plain. One also notes very often, in passing into a forest on a damp day, that the trees drip moisture, possibly condensed from moisture evaporated from the damp earth underneath. Observations of this nature, however, cannot ordinarily be checked by instrumental means, but show in a general way that the forest tends to conserve vapour and moisture which in the case of the open field would be diffused into the atmosphere.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. G. H. RENDALL, the Principal of University College, Liverpool, has been appointed Head-Master of Charterhouse School.

SIR JOHN GORST, in the course of an address at Bristol on Thursday last, is reported by the *Times* to have said that the promotion of technical education was confronted by two obstacles—the backward condition of elementary education and the want of organisation in the provision of secondary education. A good sound system of elementary education must be the groundwork for higher education, and he urged reform of the system which at present relieved children from compulsory attendance when inadequately equipped. The improvement of the organisation of secondary schools was really a matter for the people themselves. There was nothing to prevent technical instruction committees from becoming thoroughly representative and effective organisations.

THE most satisfactory point to us in the Report just issued by the Oxford University Extension Delegacy refers to the Extension College at Reading. The college is doing excellent work, more particularly in agriculture, and has amply justified its existence. New buildings are, however, imperatively needed, and in response to an appeal for 12,000*l*., 9,000*l*. has already been promised, and the new wing has been begun. The building scheme, planned four years ago, will be completed by next summer, and H.R.H. the Prince of Wales has promised to perform the opening ceremony. The educational work of the college has been attended with great success during the past year. With regard to the courses of lectures delivered under the auspices of the Delegacy during the year 1896-97, we notice that out of a total of 146 courses, only nineteen were on scientific subjects.

IN the course of a presidential address recently delivered before the Kansas Academy of Sciences, Prof. S. W. Williston severely criticised the system of education which makes language studies compulsory, and all, or nearly all, the sciences optional. Many educationists will find themselves in agreement with the following opinions expressed by Prof. Williston:—"I claim broadly and emphatically that the natural sciences, any or all of them, are as valuable and as necessary as pure cultural studies as are the languages; that intelligent and successful study of them will do as much, if not more, in making the student a broad man, a successful man, as will the study of Latin or Greek. And they will do more in making him an honest man. Nowhere in all the broad field of knowledge will he learn better to think exactly than in the natural sciences. Nowhere will he be more impressed with the importance of truth for truth's sake. . . . Were I, then, to say what the universities and colleges ought to do, it would be this: make all the ancient language requirements for admission optional, and demand as much preparation in the physical and biological sciences as in the foreign languages. The preparation in English should be made far more rigorous

and thorough. In the college course, if anything besides English is required, and I think there should be, I would have the natural science as necessary a part of the education as language and mathematics. I would not have it possible for a student to graduate from the college without having studied, and thoroughly studied, mathematics as far as trigonometry, at least one foreign language, and at least one physical and one biological science. And I do not mean a few weeks of study in any of these branches, but exhaustive, careful, critical study. The methods of study in all these branches are diverse, and are absolutely essential for symmetrical mind-building,"

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 25.—"Further Note on the Transplantation and Growth of Mammalian Ova within a Uterine Foster-Mother." By Walter Heape, M.A., Trinity College, Cambridge.

In 1890 an experiment was recorded (*Roy. Soc. Proc.*, vol. xlviii.), designed to show that it is possible to make use of the uterus of one variety of rabbit as a medium for the growth and complete fœtal development of fertilised ova of another variety of rabbit. The experiment was further undertaken in order to determine what effect, if any, a uterine foster-mother would have upon her foster-children, and whether or not the presence, during development, of foreign ova in the uterus of a mother would affect offspring of that mother present in the uterus at the same time. In this experiment, two fertilised ova obtained from an Angora doe rabbit which had been inseminated thirty-two hours previously by an Angora buck, were inserted into the fallopian tube of a Belgian Hare doe, which had been inseminated three hours before by a buck of the same breed as herself; and in due course the Belgian Hare doe littered six young, four of which were Belgian Hares, while the other two were Angoras. This year experiments were made with Dutch and Belgian Hare rabbits, and the method adopted was the same as that described above, the result being that the Belgian Hare foster-mother gave birth to seven young, of which five were Belgian Hares and two were apparently Dutch. Both these Dutch young were, however, irregularly marked, and it appeared possible, after all, either (1) that the Belgian Hare foster-mother had influenced the Dutch fertilised ova, or (2) that these two young were really a cross between Dutch and Belgian Hare.

In order to test the first of these possibilities, the same Dutch buck was put to a tried, thoroughbred Dutch doe, and she produced a litter, every one of which was badly marked, thus showing that the bad marking of the foster-children can be justly attributed to their father's influence. The second possibility was more difficult to test. A cross between the Dutch buck and the Belgian Hare foster-mother was obviously possible, for when the foreign Dutch segmenting ova were introduced into the fallopian tube of the Belgian Hare foster-mother, they were still surrounded by spermatozoa from the Dutch buck, which were still alive, though failing in vigour. But the Belgian Hare doe had been inseminated by a Belgian Hare buck just before the operation, and the spermatozoa from this buck would arrive at the end of the fallopian tube before ovulation took place; it would be at least twenty-four hours younger than the foreign Dutch spermatozoa, and both more vigorous and in far greater numbers than the latter. The possibilities are distinctly in favour of the host of younger and more vigorous Belgian Hare spermatozoa beating the few older and less vigorous, foreign, Dutch spermatozoa in the struggle for the Belgian Hare ova; but, at the same time, it is possible that the latter won. The only way to test this at all seemed to be by crossing the same Dutch buck with Belgian Hare does, and comparing the offspring of such crosses with the young foster-children. This was done, and two Belgian Hare does each produced, in consequence, five young. Of these, three were Belgian hares splashed with white, one was black and white, three were fawn or fawn and white (the fawn being mixed with a delicate bluish dun shade), and three were thoroughbred Belgian Hares. The father's influence was seen in the introduction of white and in the fawn and dun colours. None of the young, however, at all closely resembled the Dutch breed.

With regard to the foster-children, one of them died at an early age, but the second lived, and is now more typically Dutch than it was when younger; it is coloured and shaped remarkably like the Dutch doe from which the foreign fertilised ova were obtained. The remarkable likeness is in itself very strong evidence of the origin of this young one, and when considered in conjunction with the results obtained by crossing the Dutch buck with Belgian Hare does, there can be little doubt it was derived from Dutch parents. This result, supported by the result obtained in 1890, is greatly in favour of the contention, that it is possible to make use of a uterine foster-mother, and to do so without thereby influencing any of the young which are nourished by her.

It is worthy of notice, if the above is true, that in case telegony be actually demonstrated, the characteristics of a primary husband transmitted to the offspring got by a secondary husband, can only be so transmitted through the ova of the mother.

"Mathematical Contributions to the Theory of Evolution. IV. On the probable Errors of Frequency Constants and on the Influence of Random Selection on Variation and Correlation." By Karl Pearson, F.R.S., and L. N. G. Filon, University College, London.

A brief indication of the nature of the contents of this paper is given on p. 210.

December 9.—"On the Calculation of the Coefficient of Mutual Induction of a Circle and a Coaxial Helix, and of the Electromagnetic Force between a Helical Current and a Uniform Coaxial Circular Cylindrical Current Sheet." By J. Viriamu Jones, F.R.S.

Zoological Society, December 14.—Lieut.-Colonel H. H. Godwin-Austen, F.R.S., Vice-President, in the chair.—Mr. G. A. Boulenger, F.R.S., offered some further remarks upon the Siluroid Fish, *Vandellia cirrhosa*.—A communication was read from Dr. E. A. Goeldi, "On *Lepidosiren paradoxa* from the Amazons." This memoir treated of the geographical distribution of the *Lepidosiren* on the Amazons, and of its external structure and dimensions, and gave an account of its habits in a natural and captive state.—Mr. J. Graham Kerr gave an account of his recent expedition, along with Mr. Budgett, to the Chaco of Paraguay in quest of *Lepidosiren*; and made remarks on its habits as there observed. Mr. Kerr also gave a general account of the early stages of its development, drawing special attention to the presence in the larva of external gills and a sucker similar to those of the Amphibia.—A communication was read from Dr. A. G. Butler, containing a list of thirty-three species of butterflies obtained by Mr. F. Gillett in Somaliland during the present year, and giving the dates of the capture of the specimens and their localities.—Mr. Oldfield Thomas read a paper entitled "On the Mammals obtained by Mr. A. Whyte in North Nyasaland, and presented to the British Museum by Sir H. H. Johnston, K.C.B.; being a fifth contribution to the Mammalogy of Nyasaland." This memoir contained notes on sixty-one species of Mammals, four of which were characterised as new, viz. *Macroscelides brachyrhynchus malosæ*, *Crocidura lixa*, *Myosorex soulla*, and *Graphiurus johnstoni*.—A communication was read from the Rev. O. Pickard Cambridge, F.R.S., describing a new genus and species of Acaridea (*Eatonia scopulifera*) from Algeria.—A communication by Mr. J. Stanley Gardiner, "On some collections of corals of the family *Pocillopori*dæ from the South-west Pacific Ocean," was read by the author. Twenty species of the genus *Pocillopora* and one of the genus *Seriatopora* were enumerated and remarked upon, five species of the former genus being described as new, viz. *Pocillopora septata*, *P. obtusata*, *P. coronata*, *P. rugosa*, and *P. glomerata*.—Mr. W. E. de Winton gave an account of a collection of Mammals from Morocco, made by Mr. E. Dodson on behalf of Mr. J. I. S. Whitaker. Twenty-one species were enumerated as represented in the collection, of which the following were described as new: *Crocidura whitakeri*, *Mus peregrinus*, and *Lepus atlanticus*.

DUBLIN.

Royal Dublin Society, November 17.—Dr. F. T. Trouton, F.R.S., in the chair.—Dr. G. Johnstone Stoney, F.R.S., presented a paper upon atmospheres upon planets and satellites (see p. 207).—Mr. W. E. Wilson, F.R.S., read a paper upon the apparent cometary nature of the spiral nebula in Canes Venatici. The paper was illustrated by a remarkably fine photograph of the nebula taken in February 1897, by the author.—Dr. F. T. Trouton read a paper upon the arrangement of the crystals of