

the publication of the fact that Mr. Kelsall and Mr. Dale, secretary of the Hants Field Club, might be able "to accompany the party on one or more of its rambles" a sufficient guarantee that the rights of wild plants would be respected.

Furthermore, on the title page of the vacation course programme, p. 9, and printed in conspicuous black type, is the following notice: "Members of the party will, of course, refrain from uprooting rare or scarce specimens." Yet Prof. Miall alleges "there was no such restriction in the printed programme"!

In the daily itinerary as printed in the programme reference is made to the character of the scenery, the soil and surface geology, the prevailing vegetation, and to some of the rare plants growing in the neighbourhood. From what we have already shown it could hardly be our intention to raid these rare plants, and especially as several of those mentioned will be out of flower in August. Indeed, so particular are we in these rambles that the needless uprooting even of the commonest weed is discountenanced, as may be seen in the further notice on p. 3 of the programme.

In comparison with such a particularly odious charge as plant extermination, the other strictures of your correspondent's letter are, of course, scarcely worth noticing; yet even with respect to these I cannot resist pointing out that Prof. Miall's statements are strangely at variance with the actual facts. For example, he writes: "It is enough to condemn the programme as an educational project that novices knowing little or nothing of field-botany are set to study the subspecies of brambles." But does the programme so recommend? It distinctly says in reference to this (p. 18), that "their identification will give capital exercise in critical observation to the *more advanced worker*."

The real object of these field-studies, as stated on the front page of our programme, is to give teachers "an insight into the way in which plants grow, especially in their relations with their environment—the influence of external conditions, such as light, heat and moisture, upon their form, the mutual relationships between plants and animals and the influence of one organism upon another," and is in no way connected with collecting in the sense used by Prof. Miall. The vacation students have varied interests—flowering plants, algæ, leaf-fungi, &c., and the evenings are to be spent in discussing "the most interesting of the objects collected" and on the "preservation" of such as may be useful for class-work in the winter courses. Readers of NATURE will understand that work of this sort does not mean the collection of rare flowering plants.

Perhaps because of the peculiar gravity of the charge I may, in conclusion, be allowed to introduce one personal note into the reply. I should like to say that although I have conducted field studies in botany for the last twelve years (including two summer courses at the New Forest), yet, as it happens, I am no collector myself, and have never made what botanists would call a collection of dried plants in my life. Furthermore, I have never possessed, or even "coveted," a single specimen of a rare British plant. On the contrary, my sympathies are, of course, entirely with those who are opposed to any interference with our native flora, and I do most strongly protest against this attempt of Prof. Miall to connect in any way whatever our botanical work with such objectionable practices.

I should be glad to send a copy of the programme to any one who may care to see it.

DAVID HOUSTON.

County Technical Laboratories, Chelmsford, June 10.

Emanations from Radio-active Substances.

IN a recent number of the *Comptes rendus* of the Paris Academy (March 25) an account appeared by MM. P. Curie and A. Debierne of the production of a radio-active gas from radium. In their experiments some radium was placed in a glass vessel and the air exhausted by means of a mercury pump. It was found that the vacuum steadily decreased, due to the giving off of a gaseous substance from the radium. A small amount of the gas thus collected was found to be strongly radio-active. It caused phosphorescence in the glass tubes over which it passed, and in course of time blackened them. Substances exposed in the gas became themselves temporarily radio-active.

Some time ago (*Phil. Mag.*, January and February 1900) I showed that thorium compounds continuously emitted radio-

active particles of some kind, which preserved their radio-activity for several minutes. This emanation possessed the remarkable property of causing all bodies, in contact with it, to become themselves radio-active. In an electric field the excited radio-activity could be concentrated and confined to the negative electrode. In this way I was able to make a fine platinum wire become a very powerful source of radiation.

The excited radio-activity gradually diminished, falling to half its value in about twelve hours. The specimen of impure radium then in my possession gave out no emanation and caused no excited radio-activity. Later, Dorn, using the same methods, showed that a preparation of radium from P. de Haen, Hanover, gave out an emanation similar in properties to thorium. With a specimen of radium obtained from the same source I have found that the emanation given off is small at atmospheric temperature, but can be enormously increased by slightly heating the radium. In this way I have obtained ten thousand times the amount of emanation given off at ordinary temperatures. An account of these experiments is given in the *Physikalische Zeitschrift* (April 20).

By passing the emanation with a current of air into a closed vessel, and then closing the openings, the emanation remains radio-active for a long time. The radio-activity decreases slowly, but is still quite appreciable after an interval of one month. M. and Mme. Curies, some time ago, stated that they had obtained a radio-active gas which preserved its activity for several weeks; this is possibly identical with the emanation.

Up to this point I had been unable to obtain any definite evidence whether the so-called emanations were vapours of the radio-active substances, radio-active gases, or radiating particles large compared with a molecule. The radium and thorium, when placed in an exhausted tube, gave no appreciable lowering of the vacuum, and no new spectral lines could be observed. The quantity of substance emitted was too small to examine by chemical methods.

Quite recently, however, some light has been thrown on the question of the nature of these emanations by examining their rate of diffusion by an electrical method. In these experiments I have been assisted by Miss H. T. Brooks, and the results point to the conclusion that the emanation from radium is in reality a radio-active gas, with a molecular weight probably lying between 40 and 100.

There is one distinct feature which distinguishes the emanations from radium and thorium. The thorium emanation loses its radio-activity in a few minutes, while the excited radio-activity due to it lasts several days. The radium emanation, on the other hand, preserved its radiating power for several weeks, while the excited radio-activity due to it disappears in a few hours. In the following experiments it was only possible to experiment with radium emanation, on account of the rapid decay of radio-activity of the thorium emanation.

The diffusion apparatus was similar to that which had been employed by Loschmidt in 1870 in his determinations of the coefficients of interdiffusion of gases.

A brass cylinder, 73 cm. long, 6 cm. in diameter, was divided into two equal parts by a metal slide, which could be opened or closed. The ends were closed by insulating ebonite stoppers, through which passed central rods half the length of the tube. In order to introduce the emanation into one half of the cylinder the slide was closed, and a slow current of air, which had passed over slightly heated radium and thus carried the emanation with it, was passed through the cylinder. When a sufficient amount had been introduced the current of air was stopped and the openings closed. After standing for an hour or more the slide was opened, and the radio-active emanation slowly diffused into the other half of the cylinder. The amount of emanation in each half of the cylinder after any interval was tested by observing the current through the gas, when a suitable P.D. was applied, by means of an electrometer. The current is carried by the gaseous ions which are continually produced by the radiation from the emanation. From these observations the coefficient of inter-diffusion of the emanation into air at atmospheric pressure and temperature can be readily deduced. The experiments are, however, complicated by the excited radio-activity on the electrodes, which must be taken into consideration.

So far as the observations have gone up to the present, the coefficient of diffusion of the emanation into air has a value between 0.10 and 0.15, and probably nearer the former. Now the coefficients of inter-diffusion of some known gases and vapours

into air have been determined. The following examples have been taken from Landolt and Bernstein's tables :—

Gas or Vapour.	Coefficient of Diffusion into Air.	Molecular Weight.
Water vapour	0.198 ...	18
Carbonic acid gas	0.142 ...	44
Alcohol	0.101 ...	46
Ether	0.077 ...	74

In the above we see that the coefficients of diffusion follow the inverse order of the molecular weights. In cases of the simpler gases it has been shown experimentally that the coefficient of inter-diffusion is approximately inversely proportional to the square roots of the product of the molecular weights. If we apply these considerations to the emanations we see that it is a gas or a vapour of molecular weight (allowing a wide margin) probably lying between 40 and 100. These numbers exclude the possibility of the substance being a vapour of radium, for it has already been shown by M. and Mme. Curie that the atomic weight of radium is greater than that of barium.

We must, therefore, conclude that the emanation is in reality a heavy radio-active vapour or gas.

On account of the rapid decay of the radiating power of thorium emanations it is not possible to determine its coefficients of diffusion in the same way; but special experiments show that it diffuses rapidly, and is also probably gaseous in character. The physical properties of these emanations or gases are most remarkable. The radium emanation not only continues for long intervals to be a source of radiation which is apparently similar in character to easily absorbed Röntgen rays, but in some way manufactures from itself a positively charged substance, which travels to the negative electrode and becomes a source of secondary radio-activity.

Space is too short to enter into the interesting question of the possible explanation of these complicated phenomena.

McGill University, Montreal, May 30. E. RUTHERFORD.

Long-tailed Japanese Fowls.

A LITTLE while ago in your columns Prof. Lankester referred to this breed as "a magnificent sport," and considered the occurrence of genius in mankind as a case of the same kind. In Newton's "Dictionary of Birds," article "Feather," it is stated that in these Japanese poultry the moult is checked or prevented by some means unknown to Europeans. It is obvious that the latter statement, if correct, is not compatible with Prof. Lankester's description. If the breed really arose as "a magnificent sport," I presume that the excessive growth of the tail coverts would be due to a spontaneous variation, and not to some artificial method of preventing the annual moult. After a great deal of trouble I have succeeded in obtaining evidence, which seems to me unimpeachable, concerning the means taken by the Japanese to produce this extraordinary elongation of feather in the cocks of the breed in question.

I will quote the words of my informant. He writes :—"With regard to the treatment of these birds, in order to ensure very great length of tail, they ought after they are six months old to be kept on a perch as much as possible, and the tail feathers should be pulled gently every morning, grasping the centre bone-like part firmly with the finger and thumb, and, pressing steadily, draw downwards towards the tip, each feather being done several times; this softens the quill and causes it to lengthen. They do not moult the feathers, but if one or more come out others immediately grow in their place. The Japs themselves, those who take great pride in their birds, always roll the long feathers up, like a lady rolls up her hair, and tie them, whenever they are let off their perches to walk about, which is about twice a day for an hour at a time. . . .

"I have often seen them thus treated in Japan, and the man who brought mine over treated them in this way on the voyage over, and I sent them (to purchasers) in their regular perch cases."

I think this, being the evidence of direct observation, is enough to prove that the length of feather in these birds is not correctly described as a "sport," but has been produced by special artificial treatment. The effect of the treatment is doubtless to irritate the papilla from which the feather grows, and so cause increased growth, rather than to soften and lengthen the already formed quill. The feathers appear to grow throughout the year, so that when the moulting season is reached they are not shed, but continue growing.

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There is no doubt that the peculiarity is to a certain extent hereditary, but extreme length of feather cannot, I believe, be produced without the special treatment. These fowls have been bred in England, and I have seen specimens which had tail coverts (and also hackles) longer than those of any European breed, but so far as I know no specimens bred in Europe have produced the extraordinary length of feather that is known to occur in Japanese specimens, for example in the two stuffed specimens in the hall of the Natural History Museum. It seems to me reasonable to conclude that the hereditary effect is due to the artificial irritation applied to a long succession of generations. J. T. CUNNINGHAM.

Variation in a Bee.

ON September 24, some years ago, I collected at Mesilla, New Mexico, four examples of a wild bee of the genus *Epeolus*, the species being probably identical with *Epeolus bardus* of Cresson. In every one of these specimens the second transverso-cubital nervure is incomplete, its lower half being wanting, on one or both sides. In one example only is the nervure incomplete on both sides; in the other three it is incomplete on the right side only. Such aberrations are not very uncommon among bees, but they usually occur in single examples, and this is the best instance known to me of their being inherited by a number of individuals. What is here clearly a sport seems in a fair way to become a racial character, and we seem to have a good example of Bateson's "discontinuous variation." In the genus *Ialictus* certain species have only two submarginal cells, instead of the usual three, and the same is true of *Andrena*. These peculiar species are related to different groups of the genera to which they belong, so that if it is proposed to regard them as pertaining to distinct subgenera (or genera) by reason of their venation, it becomes necessary to propose several sub-generic names instead of one, because of the independent evolution of the species. That this evolution has resulted from the perpetuation of sports such as that described above we can hardly doubt, but we are not thereby compelled to admit that it may not also be beneficial to the species.

T. D. A. COCKERELL.

East Las Vegas, New Mexico, U.S.A., May 25.

Foreign Oysters Acquiring Characters of Natives.

THE facts contained in Mr. Tabor's letter, however interesting, supply no evidence for or against Lamarckism. When at Whitstable, the individual French oyster has certain characters impressed upon it by its environment. The next generation, when compared with the natives, show certain peculiarities, such as greater thickness of shell and greater growing power. But this also we are able to interpret as the response of the individual to the environment. If the peculiarities appear in many successive generations, the same explanation will account for the facts. If, however, Lamarckians could show that the effect of the environment, as the generations succeed one another, is cumulative, that the characters in question become progressively accentuated, then they would prove their case. But it does not appear that they have any such evidence at their command. F. W. HEADLEY.

Haileybury College, Hertford.

ITALIAN EXPLORATION IN ARCTIC REGIONS.

THE recent success of the Duke of the Abruzzi's expedition, which carried the Italian flag nearer the North Pole than ever flag flew before, has doubtless prepared a public in Italy for the literature of Polar exploration. The firm of Hoepli, who have conferred many favours on Italian-speaking geographers, have just published a history of Polar exploration in the nineteenth century by Signor Hugues.¹ The book makes no claim to originality, being merely a condensed popular description of the Polar voyages of the late century, and although more detailed on account of the shorter range of time dealt with, and coming down to the year 1900, it cannot compare with General Greely's compact handbook as a work of reference for the student. The most serious drawback is the want of a bibliography or a uniform

¹ "Luigi Hugues—Le Esplorazioni Polari nel Secolo XIX." Pp. xx + 374. Maps and Illustrations. (Milano: Ulrici Hoepli, 1901). Price 12 lire.