scientific investigator, and that it is only a question of time when the problems still awaiting solution will cease to puzzle us."

This important change in the character of the subject is made the foundation of a claim for its fuller recognition by the University.

"In considering what should be the place of agriculture in University teaching, it is of primary importance that we should grasp the fact of the existence of this great body of agricultural science which has grown up during the last century. If agriculture is still merely an art, it has no proper place in University teaching, and those who wish to learn it must resort to some technical school for the purpose. If, on the other hand, agriculture is now as much a department of science as geology or medicine, it has an undoubted claim to be recognised, and its claim becomes urgent when we consider the vast importance of the subject."

The most important steps which have been taken in the development of agricultural teaching are then noticed, especial emphasis being laid on the great extension of such teaching during the last ten years, chiefly through the exertions of the County Councils and the Board of Agriculture. Not only have the means of instruction been greatly increased, there has also been a remarkable growth of opinion among the higher class of agriculturists as to the value of a thoroughly scientific training in the department of agriculture. Thus, in February 1893, the Council of the Royal Agricultural Society passed the following resolution:—"That, in the opinion of the Royal Agricultural Society of England, it is desirable that provision be made in all Universities for the granting of a degree in Science for students of agriculture." The same Society gave evidence before the Royal Commission on the proposed Gresham University for London, and urged that a degree for students in Agriculture should be given by the new University.

Prof. Warington next proceeds to mention what is being at present done in the way of agricultural teaching by British Universities and University Colleges. It appears that the Universities of Edinburgh, Glasgow, Aberdeen, Durham, and Wales, all grant the degree of B.Sc. in Agriculture to students who have successfully passed examinations in agriculture and in the sciences connected therewith. The scheme for agricultural instruction at Cambridge did not succeed in passing the Senate; this University now grants a diploma in Agriculture, the examination for which is open to all-comers. About one half of the University Colleges in England give a complete course of agricultural teaching. Besides these, there are the purely agricultural colleges, to which many additions have recently been made by the County Councils.

The question is then asked, Does this great extension of agricultural teaching in recent years meet all our requirements? The answer is that it does not.

"A real effort is being made to instruct and elevate the farmer and the more intelligent of the labouring class, while the landowner, who finds his education at Oxford or Cambridge, is left without the opportunity of fitting himself for his subsequent duties, and consequently cannot be expected to act the part of a wise leader in the march of improvement which has become so necessary. In the Universities of Oxford and Cambridge there are, I suppose, about 5000 undergraduates, of whom a considerable proportion will in after life have the management of land. A proper provision for the teaching of agriculture in these Universities would, I believe, do far more to improve the condition of agriculture in this country than is effected by all the Government grants distributed by the Board of Agriculture."

Prof. Warington considers, in conclusion, what may be usefully done at Oxford in the direction just indicated. The twelve annual lectures required by statute from the Sibthorpian Professor, unconnected as they are with any examination or degree, are productive of little good. He does not ask that the University should institute a degree in Agriculture, or even that they should at present deal with the subject in any large or comprehensive way. The proposal is that Agricultural Science should be placed among the science subjects, of which two may be selected as part of the final examination for a Pass degree. This plan would merely require the provision of additional lectures, so that agricultural science might be taught throughout the whole academic year. If this modest scheme were adopted the agricultural teaching would become effective, being tested by examination, and leading to that goal of all University men—a degree.

We do not wish to express an opinion on the details of a University scheme; but we heartily wish success to Prof. Warington's proposal. The function of a University is the education of the mind, and the propagation of knowledge; and such an important branch of knowledge as agricultural science should certainly find a place in our schemes of University education.

DR. KOCH'S REPORTS ON RINDERPEST.

THREE reports have now been published by Dr. Koch on Rinderpest. The Cape of Good Hope *Agricultural Journal* for January 14, reprints the first two, whilst the third has appeared in the weekly edition of the *Cape Times* of February 10. The first is dated December 9, four days after Dr. Koch arrived at Kimberley, and the second and third, January 3 and 31 respectively. All hail from Kimberley, which city Dr. Koch has made his headquarters for the present. The scientific experiment station, which has been arranged and fitted up for him, is situated about two miles out. Dr. Edington's research station is at Taungs, where it is stated that the inhabitants have lost as many as 20,000 head of cattle from the pest. It will be remembered that Dr. Edington has discovered and cultivated certain micro-organisms which he believes to be the virus of cattle plague, and Dr. Koch is carrying out some experiments with cultures, placed at his disposal by Dr. Edington, to ascertain what, if any, part is played by them in the disease. Elaborate precautions have had to be taken at the Victorian Compound, Dr. Koch's station, to avoid accidental infection of the animals under observation, which would entirely vitiate the inquiry. Dr. Koch provided himself with blood and other materials obtained from plague-stricken animals, and with these he has already carried out a large number of inoculation experiments. In the first instance an efficient method had to be discovered of infecting animals artificially with the disease, for the methods hitherto employed were not attended with the desired success. Koch, instead of using the secretions of infected animals, has employed hypodermic injections of blood taken from rinderpest victims, and this method has proved extremely successful. All efforts so far to find, whether by cultivation, or microscopical examination, a specific micro-organism in the blood have proved fruitless; neither has any specific microbe been discovered among those abundantly present in the mucus from the nose, the secretions, and other mucous membranes. Dr. Koch has no intention of abandoning the search, but at present his efforts are concentrated upon finding a process which may attenuate the virus of rinderpest, so as to transform it into an antidote. The first steps in this direction were made by inoculating animals, such as sheep and goats, less susceptible to the disease than other cattle, with rinderpest blood. The symptoms, consequent upon these inoculations, resembled those of a mitigated attack of rinderpest; the blood of these animals inoculated into other sheep and goats also induced symptoms of mild rinderpest, and the hope was raised that after these inoculations had been continued through further generations, the blood of these animals might induce a modified attack of the disease in cattle. This hope proved, however, illusory, for cattle succumbed rapidly to rinderpest after such inoculations. Dr. Koch has also been endeavouring to produce an attenuated virus by chemical and physical means. Rinderpest blood mixed with glycerine appears to suffer some abatement of its virulence, whilst even better results followed the addition of phenol to the virus. Cows inoculated with rinderpest blood and phenol did not contract the disease; moreover, when subsequently inoculated with virulent blood, they remained healthy. These experiments are being continued. A most noteworthy experiment was, however, the dessication of rinderpest blood at a temperature of 31° C. during a period of four days. A head of cattle inoculated with this blood dissolved in water remained perfectly healthy. Unfortunately, however, although the inoculation produced no effect upon the animal, it also afforded it no protection from subsequent infection with fresh rinderpest blood. Of all the animals which have been infected with rinderpest blood at the experimental station, only four have recovered, and Dr. Koch has used them for ascertaining whether the blood of immune animals, for they did not contract the disease when reinoculated, possesses any protective power. The results were encouraging, for this blood certainly did exert a distinct immunising action; but it remains to be seen

how long this immunity lasts in animals thus vaccinated against rinderpest. It has been ascertained that neither birds, such as fowls, doves, pigeons, guinea-fowls, and cranes are susceptible to the pest. An eagle and a secretary-bird were fed for weeks on intestines taken from rinderpest animals, but absolutely no ill-effect followed. Dogs and donkeys are also immune, as are likewise mice, guinea-pigs, and rabbits; to pigs only, so far, does it appear possible to transmit the infection. In conclusion, Dr. Koch's investigations with Dr. Edington's plague microbe have proved that the latter is not the cause of rinderpest.

NOCTURNAL AND DIURNAL CHANGES IN THE COLOURS OF CERTAIN FISHES AND OF THE SQUID (LOLIGO), WITH NOTES ON THEIR SLEEPING HABITS.[1]

WHILE investigating the nocturnal habits and colours of some of our native marine fishes, in 1885 to 1887, at Wood's Holl, Mass., in the laboratory of the U.S. Fish Commission, of which I had charge at that time, I made the unexpected discovery that a number of species had the peculiar habit of assuming, while sleeping, a style of colouration quite unlike that seen in the daytime. Numerous other duties prevented me from making as many observations of this kind as I wished, at that time, nor have I since had opportunities to continue them. Therefore I have decided to publish these incomplete observations, with the hope of inducing other naturalists to continue such studies in some of the various zoological stations that are now established.

Most of my observations were made late at night, between midnight and 2 o'clock a.m., when everybody else had retired. The gas jets near the aquaria were turned down so low as to give barely light enough to distinguish the forms and colours of the fishes. Under these conditions, by using great care not to cause any jar of the floor, nor sudden movements of any kind, I succeeded in observing many species asleep. Most fishes sleep very lightly, and are aroused by almost imperceptible vibrations of the air or water. Some of these fishes took unexpected attitudes while asleep.

In many cases the change of colour from that seen while awake, or in the daytime, consisted in a simple increase in the depth or intensity of the colours, the pattern of colours remaining the same. This was the case with several species of flounders. Those that are spotted or mottled with dark pigment showed their markings much more strongly, or in greater contrast with the ground-colour, than by day. Several species of minnows (*Fundulus*), which are marked either with longitudinal or transverse dark bands, have these markings more decidedly black and better defined than by day. The same is true of the king-fish (*Menticirrus nebulosus*), in which there are obliquely transverse dark stripes that come out more strongly at night than by day.

The black sea-bass (*Serranus furvus*) and the sea-robins (*Prionotus palmipes* and *P. evolans*) presented the same phenomena. Several species of trout (*Salvelinus fontinalis*, &c.) were observed to become much darker at night than in the daytime, but I was not sure that any of those observed were asleep at the time.

It is well known that trout, flounders, and some other fishes are able to change their colours, even in the daytime, according to the colour of their surroundings. Therefore a darkening of the colours at night is to be expected, even if not asleep. But in all the cases mentioned above the nocturnal change of colour is of a protective character.

Other fishes, however, show much more remarkable changes. Among these the scup or porgy (*Stenotomus chrysops*) is one of the best examples. This fish, when active in the daytime, usually has a bright silvery colour with iridescent tints. But at night, when asleep, it has a dull bronzy ground-colour, and the body is crossed by about six transverse black bands. When one of these fishes, with this colouration, was awakenedby suddenly turning up the gas, it immediately assumed the bright silvery colours belonging to its daytime dress. This experiment was repeated many times, on different individuals, with the same result. As this fish naturally rests among eel-grass and sea-weeds, the protective character of its nocturnal colours is obvious.

A common file-fish (*Monacanthus*, sp.) was observed that presents a very decided change in colour pattern. This species, in the daytime, is mottled with brown and dark olive-green, and the fins and tail are a little darker than the body, but when asleep, at night, its body becomes pallid grey or nearly white, while the fins and tail become decidedly black. These colours are decidedly protective at night, or in a feeble light, among rocks and weeds, where it lives. This and other species of file-fishes, when sleeping, would usually rest on the bottom with the back leaning against the glass of the aquarium, or against a stone at a considerable angle.

The common tautog or black fish (*Tautoga onitis*) has the curious habit of resting upon one side, half-buried among gravel, or partly under stones, and is often curved in strange positions. It is easy to imagine that the flounders originated from some symmetrical ancestral form that acquired, like the tautog, the habit of resting upon one side, at first only when sleeping, but afterwards continually, owing to the greater protection that this habit and its imitative colouration afforded. The one-sided colouration and the changes in the position of the eyes, &c., would gradually follow in accordance with well-known laws of evolution.

The common squid (*Loligo Pealei*) was observed sleeping on several occasions. At such times it rests in an inclined position, on the tip of its tail and on the basal parts of the arms, which are bunched together and extended forward, so that the head and anterior part of the body are raised from the bottom, so as to give room for breathing. The siphon tube is then turned to one side. Under these circumstances the colour is darker and the spots more distinct than when it is active, owing to the expansion of the brown and purple chromatophores.

A. E. VERRILL.

[1] Abstract of a paper read before the American Morphological Society, December 30, 1896. These observations were also communicated to the Connecticut Academy of Sciences, in 1888, but were not published. (Reprinted from the *American Journal of Science* for February.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The Junior Scientific Club met on Wednesday, March 3, Mr. A. W. Brown (Ch. Ch.), President, in the chair. Prof. Ray Lankester exhibited and described a specimen of Cladosclache and a cast of a restoration of the skull of Thylacoleo. Both specimens have recently been added to the museum. Dr. J. S. Haldane read a paper on "The Causes of Absorption of Oxygen by the Lungs," which was followed by a lengthy and animated discussion.

CAMBRIDGE.—Dr. S. H. Vines, F.R.S., has been appointed by the Council of the Senate a Governor of the Oxford High School for boys.

The valuable collection of Pyrenean and Alpine plants, numbering about 4000, made by the late Mr. Charles Packe, of Christ Church, Oxford, has been presented by his widow to the University Herbarium.

MR. WILLIAM LAMPSON, who died recently at Le Roy, near Rochester, in the State of New York, left the bulk of his estate, valued at about one million dollars, to Yale University, from which he graduated in 1862.

THE Norwegian Parliament has unanimously decided to appoint Dr. Nansen to a Chair of Zoology in the University of Christiania. It is understood that the duties of the Chair will not interfere with any further explorations of the Arctic or Antarctic regions which Dr. Nansen may be disposed to undertake.

TO city and county authorities seeking a means of commemorating the sixtieth year of the Queen's reign, we commend the example of the Royal Reception Committee at Sheffield. This Committee was entrusted with the duty of preparing for the Queen's visit to that city on May 21, and at the same time of arranging a suitable mode of commemorating the Diamond Jubilee, and they have decided that the endowment of the Sheffield University College is the best object. For this end the sum of 30,000*l.* is still required, and the Committee have resolved to invite subscriptions through the Mayor, the Duke of Norfolk.