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.

THE Technical Education Board of the London County Council invite applications for a scholarship in sanitary science of the value ot £150 a year, tenable in the pathological laboratory of Claybury Asylum. Candidates must be ordinarily resident within the administrative county of London. In making the selection, preference will be given to a candidate who is a qualified and registered practitioner, and has completed his academic course. The scholar must make such arrangements as to residence as will enable him to devote his whole time to the study of the working and effects of preventable, social and industrial causes of insanity.

DR. M. W. NENCKI, director of the chemical department of the Institute for Experimental Medicine, has, states the *British Medical Journal*, recently celebrated the twenty-fifth anniversary of his appointment as Professor of Pathological Chemistry in the University of St. Petersburg. He was presented by his friends and former pupils with a *Festschrift*, which contains, amongst others, papers by Prof. Thomas Arthus, of Freiburg, and Dr. Kostanecky, of Bern. The Council of the University of Kasan, with which Prof. Nencki was connected at the commencement of his professional career, has elected him honorary member, a distinction which is considered a very high compliment in Russia.

THE following are among recent announcements :—Dr. Pompecki to be curator of the State palæontological collection at Munich; Dr. Noll to be professor of botany at Bonn; Prof. E. Wernicke has been invited to the chair of hygiene at Marburg; Dr. Franz Lafar has been invited to the chair of bacteriology and fermentation-physiology in the Technical High School at Vienna; Mr. Charles D. Walcott to be acting assistant secretary in charge of the U.S. National Museum; Mr. Richard Rathbun to be assistant secretary in charge of the office and exchanges of the Smithsonian Institution; Dr. Julius Aparicio to be director of the meteorological and astronomical observatory at San Salvador; Prof. J. Franz to be director of the observatory at Breslau, and professor of astronomy in the University there.

MAY the many instances of large benefactions to research and education in America, recorded by Mr. George Iles in *The Century* for March, act persuasively upon millionaires, and stimulate a desire to emulate the example. Mr. Iles points out that the first large gift for original research in the United States is that of 500,000 dols. received in 1838 as a bequest from James Smithson, an Englishman, who, strange to say, never set his foot in America; in 1891, another Englishman, Thomas Hodgkins, gave the Smithsonian Institution 200,000 dols. more. In bringing the results of research to the service of the public on the lines of an industrial university, the Pratt Institute in Brooklyn is instanced as doing notable work. With its endowment of 3,500,000 dols. it represents a total gift of about 4,000,000 dols. On a plane of yet higher educational activity stands the Johns Hopkins University in Baltimore, to which Johns Hopkins gave 3,500,000 dols. The University of Chicago, opened but five years ago, has already received about 12,000,000 dols. as gifts, more than half of it being from Mr. John D. Rockefeller. In 1895 Mr. Rockefeller offered this University 2,000,000 dols. in addition to his previous gifts, on condition that an equal sum should be given to it by 1900. His offer has already resulted in a gift of 1,025,000 dols. from Miss Helen Culver. Mr. Ezra Cornell gave 670,000 dols. to the University which bears his name, and the Hon. Henry W. Sage 1,171,000 dols. The cash gifts to the University aggregate 2,738,000 dols. Columbia University, New York, asked for 4,000,000 dols. to erect new buildings when removing to a new site. It received 350,000 dols. from Mr. W. C. Schermerhorn for a natural science building; 1,000,000 dols. from President Seth Low for a library; and 400,000 dols. from members of the Havemeyer family for the erection of a memorial hall. Before the new wants of the university had been declared, its medical departments received 1,970,000 dols. from the Vanderbilt family. Mr. Anthony J. Drexel gave more than 3,000,000 dols. for the foundation of the Drexel College of art, science, and industry; Mr. Marshall Field gave 1,000,000 dols. for the foundation of the Field Columbian Museum; Clark University was established by a gift of 1,500,000 dols. from Mr. Jonas G. Clark; and many other instances of generosity are mentioned by Mr. Iles. It is pointed out, however, that American science still awaits its adequate physical and chemical laboratory for pure research. Judging from the generous spirit shown by past gifts, the waiting time should not be long.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 18.—"On the Significance of Bravais' Formulæ for Regression, &c., in the case of Skew Correlation." By G. Udny Yule. Received December 14, 1896.

If two variables, x and y, be normally correlated, the means of arrays of x's associated with successive types of y's lie on a straight line, called the line of regression. In the general case of skew correlation, this straight line becomes a curve. If, however, a straight line be fitted to the curve by the method of least squares, the equation to this straight line is identical with the equation to the "line of regression" of normal correlation. Hence the formulæ given by Bravais still remain significant whatever the form of the correlation. If the regression of x on y be positive, large values of x correspond, on the whole, to large values of y, and *vice versâ*. The expression for the standard deviation of the array in normal correlation is, in the general case, interpretable as the standard deviation of the whole series of observations from the line of regression.

Similar interpretations hold good for the cases of correlation between three, four, or more variables.

"On the Iron Lines present in the Hottest Stars. Preliminary Note." By J. Norman Lockyer, C.B., F.R.S. Received January 25.

In continuation of investigations communicated to the Royal Society in 1879 (*Roy. Soc. Proc.* 1879, vol. xxx. p. 22), and 1881 (*ibid.*, 1881, vol. xxxii. p. 204), on the effect of high-tension electricity on the line spectra of metals, I have recently used a more powerful current and larger jar surface than that I formerly employed.

The former work consisted in noting (1) the lines brightened in passing a spark in a flame charged with metallic vapours, and (2) the lines brightened on passing from the arc to the spark. It was found, in the case of iron, that two lines in the visible spectrum at 4924·1 and 5018·6, on Rowland's scale, were greatly enhanced in brightness, and were very important in solar phenomena.

The recent work carries these results into the photographic region. The result is interesting and important, since seven additional lines have been found to have their brightness enhanced at the highest temperature. These, as well as the two previously observed, are shown in the following table, which also indicates the behaviour of the lines under different conditions, as observed by Kayser and Runge (K. and R.) and myself (L.) in the arc, and by Thalèn (T.) and myself in sparks :—

Lines of Iron which are enhanced in Spark.

Wave-length.	Intensity in flame.	Intensity in arc (K and R). Max.=10.	Length in arc (L). Max.=10.	Intensity in spark (T). Max.=10.	Intensity in hot spark (L). Max.=10.
4233·3	—	1	—	—	4
4508·5	—	1	—	—	4
4515·5	—	1	—	—	4
4520·4	—	1	—	—	2
4522·8	—	1	3	—	4
4549·6	—	4	5	—	6
4584·0	—	2	4	—	7
4924·1	—	1	3	6	6
5018·6	—	4	—	—	6

Combining this with former results, we seem justified in concluding that, in a space heated to the temperature of the hottest spark, and shielded from a lower temperature, these lines would constitute the spectrum of iron.

Defining the hottest stars as those in which the ultra-violet spectrum is most extended, it is known that absorption is indicated by few lines only. In these stars iron is practically represented by the enhanced lines alone; those which build up, for the most part, the arc spectrum are almost or entirely absent.

The intensities of the enhanced lines in some of the hottest stars are shown in the appended diagram, and for the sake of comparison, the behaviour of a group of three lines which are among the most marked at lower temperatures, is also indicated. In