SCIENCE NOTES.

THE wonderful progress that has been made in almost every branch of scientific inquiry has caused the nineteenth century to be designated by various terms, such as "the age of steam," "the age of electricity," and so forth. Perhaps no attribute is so applicable as that of "the age of scientific experiment." The dominating feature of all scientific work has almost necessarily been the attempt to imitate natural processes by carefully conducted experiments, and thus investigate these processes in their minutest details. Experimentation of this kind is undoubtedly a product of the nineteenth century, and it is to this, to a large extent, that we owe the enormous advances that have been made. We are not unmindful of the few great experimental observers of previous centuries; but these were men far ahead of their time, isolated indications of the trend which scientific work was to take in the years to come. The first half of the century was characterized mainly by mechanical and physical investigations; but the advent of Darwin and his co-workers initiated that extraordinary outburst of activity in the bio-medical sciences that has lasted till this day. At first sight there did not seem much hope of attaining the same exact results as in the case of the physical sciences, but with the lapse of time it is found that the probable error can be reduced to a greater and greater extent. It is in this hope and with this intention that within comparatively recent years a new branch of biology has been instituted with the distinctive title Experimental Biology. Many famous names are associated with this work—Bateson, O. Hertwig, Arnold Lang, De Vries, T. H. Morgan, and Loeb, to mention only a few of the living representatives of the school. Albeit such work is in little more than its initial stage, many important and remarkable results have already been obtained. Dr. Hans Przibram, himself an able worker in this department, gave an interesting summary of these last year.[1] The main objects of inquiry are the fundamental problems of biology—namely, development, regeneration, the laws of descent, vitality, and functional adaptation. One of the best known and most startling of these investigations is that of Professor Loeb, who has been able by means simply of chemical solutions to initiate segmentation and development in an unfertilized normal ovum from a sea-urchin. From this it may be concluded that the ovum contains to a large extent the elements of differentiation of the future organism. Illustrative of this, in a sense, is the fact that if the eggs of *Hydra viridis* are kept in the dark a white animal is produced. The phenomena of regeneration have attracted many observers, and it has been found that almost every class of animals possess a wonderful power of renewing parts of even highly-specialized organs of which it may have been deprived. These experiments may eventually have an important bearing on human surgery. Numerous instances of adaptation to changed environment or altered conditions of life have been experimentally demonstrated. Of those, one of the most interesting, perhaps, is the behaviour of the common hermit-crab when permanently deprived of the shell in which it has taken up its abode. Having lost what it has probably come to consider as its natural means of protection, it proceeds to clothe its soft and vulnerable body in hard calcareous plating just like that of the ordinary edible crab or lobster. From this the natural conclusion is that the hermit-crab has not lost the power of covering its abdomen with a calcareous case, but that it keeps it in abeyance, preferring the more expeditious plan of making use of some empty whelk-shell. The study of the interdependence of various organs, physiologically independent to all appearances, has attracted many observers, who have shown that a whole class of characters—for example, the sexual characters—may be substantially modified by changes induced in any one of them. The best known of these is, perhaps, the effect of castration, causing the male to lose decided masculine characteristics—for example, plumage, colours, etc. These are but a few of the applications of experimental methods in the field of biology. Practically every biological problem has been made the subject of experiment, and it remains to be seen how much further this will take us than have previous speculation and hypothesis.

A subject to which much attention has been devoted of late years has been the application of Mendel's law to human beings. The inquiry is as yet in hardly more than a preliminary stage, and, in fact, the whole subject of Mendelism is just beginning to find definite and concrete expression throughout the natural world. The practical investigation of Mendel's law is not an easy matter, involving, as it does, years of patient labour and close attention; and in the case of man the difficulties are greatly increased. We welcome, therefore, any attempt to throw light on the problem. In a recent inquiry[2] Dr. Berry Hart has brought forward some interesting facts which may serve to stimulate further research. The author refers to the structure of the human genital system, in which there are present not only the organs peculiar to the particular sex, but also rudiments of organs appertaining to the opposite sex. Thus, in the male, the prostatic utricle and the Müllerian hydatid of the testes are female in character, while in the female the epioöphoron is equivalent to the epididymis of the male. In Mendelian terms these vestiges may be regarded as recessives, while the proper organs of each sex are dominants. The genital tract thus contains dominant and recessive determinants in unequal proportion, and is, in consequence, itself an impure dominant. Under ordinary circumstances this in the next generation would give rise to a mixture of dominants, recessives, and impure dominants, but by a process of reasoning the author shows that in this case the dominant and recessive determinants must be regarded as coupled and acting as one whole. He further discusses the origin of the sexual elements, and, rejecting the germ-epithelium theory, argues in favour of the continuity of the germ cells from the first segmentation of the zygote. Following this line he comes to the conclusion that the zygote is the product of the union not merely of two simple sexual elements or gametes, but of a sex male gamete and a non-sex male gamete with a sex female gamete and a non-sex female gamete. In support of his arguments Dr. Hart refers to the structure of dermoid tumours in the ovary and testis. In none of these tumours is there ever any evidence of the presence of internal genital organs; they may assume the structure of almost a complete embryo, but always minus testes or ovaries. To the numerous views on the origin of these tumours the author adds the suggestion that they may arise from a non-sex gamete which has retained the power of development normally lost when the primitive germ cells are transformed into sexual gametes. This implies the existence of more than two gametes in the zygote, as mentioned above. According to Dr. Hart, Mendelism does not differentiate sex, but the sex determinants are coupled and present in the sex gamete, acting as Mendelian units. A continuation of this work is promised.

Moved thereto by certain stray references in the scientific literature of the eighteenth century, Dr. Kirstine Meyer made a search in the libraries of Copenhagen for any records which might confirm the surmise that Ole Römer, a Danish physicist, who lived at the beginning of that and the end of the preceding century, had devised the first thermometer. The success which rewarded the search is recorded in an inaugural dissertation given at Copenhagen last year, and in a special article contributed by the author to *Nature*.[3] In a manuscript volume entitled *Adversaria*, containing notes in Römer's handwriting, are some entries which seem to prove that somewhere about 1702 he constructed thermometers with two fixed points—the temperature of melting snow and of boiling water—and with the cubic contents of the tube divided into equal parts. As this was some six or seven years before Fahrenheit made his first thermometer, there would seem to be good grounds for looking on Römer as the father of the modern thermometer. He appears to have grasped the theoretical aspects of the problem very completely, and not only to have foreseen the practical difficulties but to have solved some of them. He appears to have chosen a tube 8 in. long with a bulb blown at one end, and to have used alcohol tinted with saffron as the fluid. By means of a drop of mercury he ascertained whether the tube was regular, and rejected

[1] *Verhandl. d. Kais.-könig. zool.-botan. Gesellschaft in Wien*, 1908, pp. 171-180.

[2] *Proc. Roy. Soc. Edin.*, xxix (1909), pp. 607-618.

[3] *Nature*, vol. lxxxii, p. 296.

irregular forms; he divided the tube into four equal parts, and then determined that the scale of the thermometer should have sixty divisions (degrees) arranged in such a way as to read: "Boiling, 60; snow without cold or warmth, 7½." In concluding his instructions for making the instrument, he wrote: "When the thermometer is completed, filled, and closed, fix by means of snow or crushed ice the point of division 7½, by means of boiling the point 60." Why Römer fixed on 60 for the number to express his upper limit, the boiling point of water, is not clear; but having chosen that number, and having found it easier to divide the whole tube into four equal parts, it was natural that he should mark his other fixed point—the melting point of snow—7.5 and not, for instance, 15, because he might expect to find more uses for the thermometer above than below the freezing point. The further reason may have been that he had no knowledge of very low temperatures, lower than that of a freezing mixture, and there is some evidence that he had the temperature of a freezing mixture in mind. Apparently he afterwards fixed 8 on his scale as the freezing point, and, if a passage in Boerhaave's writings is correctly interpreted, altered his scale again, so that the freezing point was marked 32, as in the modern Fahrenheit thermometer. It is known that Fahrenheit visited Denmark and Sweden to confer with the most famous mathematicians, so that it is fairly certain that he must have met Römer and seen his original or standard thermometer, and it is very significant that in some of Fahrenheit's earliest thermometers freezing point was marked 7.5. Moreover, when Barnsdorf, the mathematical tutor to whom Fahrenheit is said to have confided his secrets, set to work to construct thermometers he put 7.5 at the freezing. The evidence, therefore, for the view that Fahrenheit derived the main principle of the thermometer—the two fixed points—from Römer is fairly conclusive. The history of the Fahrenheit scale would, according to Meyer's story, be this: Römer's original 7.5 for the freezing point was very soon changed, possibly by himself, to 8, and zero came to be identified with the temperature of a freezing mixture. For greater accuracy of observation each degree was divided into 4, giving $4 \times 8 = 32$ below the freezing point; carrying degrees on the same scale upwards it was found by experiment that the boiling point of water must be marked 212.

The idea of plants and trees possessing eyes is not a new one, but until recently no great interest had been taken in the subject. The researches of two German botanists have shown how widely prevalent such organs are. To us hitherto plants can hardly fail to have seemed dead-alive sort of creatures, eking out a monotonous existence, and having few pleasures such as we understand them. The special senses are at once the seat of all our pleasures and a distinctive mark of superiority of the animal over the vegetable kingdom. In view of the above-mentioned communications, however, it would appear that this superiority is actually not so great as we may have been led to suppose, and that trees can see and appreciate the brightness of a summer's day almost to the full as well as we can. Seefried and Haberlandt, working independently, have examined numerous species of trees and plants belonging to common families like the oak, elm, buttercup, etc., and have found in all of them on the upper surface of the leaves eye-cells, or, rather, organs of light perception, as they are more properly called. They consist of epidermal cells, of which either the outer or the inner walls are arched, and so form concentrating lenses. In addition to these simplest forms, there are many special modifications, such as conical papillae, over the outer wall. These papillae frequently assume a lenticular shape, and in other cases a lens-like structure is formed by a simple thickening of the outer epidermal wall; very many different devices, in fact, are resorted to in order to provide lenses, one of the most ingenious being a modification of some of the ordinary leaf hairs. It is obvious that these so-called eyes are somewhat primitive structures compared with that model of perfection, the vertebrate eye, but they are quite as highly organized as the structures which are dignified with the term "eyes" in some of the more lowly groups of invertebrates. In the case of the tree, however, their function is much more localized and circumscribed, but the exact extent of this function is not determined.

MOTOR CARS FOR MEDICAL MEN.

THE RELATIVE COST OF HORSE AND MOTOR.

THE Secretary of the De Dion-Bouton (1907), Limited, has sent us the following estimate of the comparative cost of horse and motor traction for a distance of 5,000 miles a year. The secretary informs us that the figures given for horse traction are based partly on those published in the JOURNAL of May 18th, 1907, and partly on the information he has obtained from personal experience. The estimates do not in either case, it will be observed, include the charges for coach-house and stable or motor house, nor for depreciation.

COMPARISON OF ESTIMATED COST FOR MEDICAL MEN OF HORSE AND MOTOR TRACTION (DISTANCE 5,000 MILES A YEAR).

Horse Traction.	£	s.	d.	*Motor Traction.*	£	s.	d.
Capital Outlay:				Capital Outlay:			
2 horses at £50 ...	100	0	0	8 h.p. chassis with body hood, screen, lamps, tools, etc., £275 to £325, say ...	300	0	0
2 sets harness... ...	20	0	0				
1 brougham	120	0	0				
	240	0	0				
Annual Expenses:				Annual Expenses:			
Coachman	65	0	0	Motor man	65	0	0
Livery	6	0	0	Livery	6	0	0
Forage and litter for two horses... ...	78	0	0	Petrol, 200 gallons, at 1s. 2d....	11	13	4
Shoeing and vet. ...	12	0	0	Oil and grease ...	2	10	0
Repairs and tyres ...	10	0	0	Carriage repairs, etc.	10	0	0
Licence, carriage ...	2	2	0	Machinery repairs and replacements	15	0	0
				Tyre repairs and replacements	20	0	0
				Licence, carriage ...	2	2	0
				Licence, two driving	0	10	0
	173	2	0		132	15	4

THE DUST QUESTION.

In a lecture on the "Mechanics of Dust," delivered recently before the Society of Engineers, Mr. C. H. W. Biggs said that in all scientific attempts to abolish the dust nuisance the aim must be to avoid the presence on public roads of matter so small in bulk or light in weight as to be capable of being moved either by wind or by the draught set up by the passage of rapidly moving vehicles. The problem, in short, was how to secure that the matter known as dust should always be collected into masses too large and heavy to be distributed in the atmosphere. The use of water carts had this effect, but the action of water was very temporary, and if water carts were so constantly used as to keep down dust, the expense entailed was very large. A considerable number of adhesive materials had been tried as a substitute for water, but up to the present none had been discovered which proved more than a temporary palliative. The ideal material would be an agglutinative which, once incorporated with the road surface, continued to act until that road surface had to be replaced by a new one.

THAMES CARS.

In an account of the Thames Car published at page 1559 of the issue for November 27th, 1909, it was mentioned that an ordinary Thames car chosen out of stock had established a record at Brooklands for 50, 100, and 150 miles. This was in November, 1907. We are informed that last November a corresponding car has established a further record by travelling 261 miles in three hours, which is some 50 miles further than the highest previous record. The driver on the first occasion was Mr. Clifford Earp; on the second Mr. C. L. Smith.

MOTOR CYCLE.

H. K. asks for advice as to the choice of a motor cycle which would have sufficient power to take a side car on ordinary country roads. The inquirer would object to a machine which required him to start it by running alongside and jumping on when in motion.

SPARKING PLUGS.

DR. H. W. S. WILLIAMS, of Castle Hill, Holywell, North Wales, is anxious to get into communication again with a person who travels in sparking plugs. The traveller appears to have pointed out to our correspondent that the pole in the plug he had to sell was of different metal to the remainder of the plug, and to have added that the mica insulation was bored out of the solid. Our correspondent has since remembered that he had not previously heard of mica except in flakes. On several previous occasions we have received communications from correspondents who had reason to be dissatisfied with sparking plugs sold by travelling agents. It would seem to be preferable to deal with established firms known in this country.

THE fifteenth International Congress of Hygiene and Demography, which was fixed for the end of September this year, has been postponed to 1911.