It is arranged that an international bureau will be established for the purpose of regulating investigation and promoting uniformity in the methods of testing both machinery and products under the action of cold. The necessity of some such bureau was conclusively shown in the discussion on units. Certain people were desirous of introducing other than the C.G.S. units, and of stereotyping such units as the "frigorie" by a definition other than the present one of a negative calorie. It was felt, however, that these questions were too large for the section to discuss, and impossible for a full congress, so that they were left for the projected commission or bureau.

A question of prime importance in connection with the congress is that of a knowledge of the properties of the various non-conductors of heat used in practice. Up to the present most of the determinations published have been either on too costly materials or else on common materials in other conditions than those used in practice. The determination of coefficients of conductivity is one of no small difficulty, and an interesting review of various methods was given by Mr. W. D. A. Bost. A large series of careful measurements of the coefficients of conductivity of material in the form of thin plates has been made by M. A. Desvignes, using Lodge's modification of Forbes's method. Since the temperature coefficient for such bad conductors appears to be very small, the error introduced by applying such numbers to temperatures lower than the ordinary at which they were determined can only be one or two per cent. Much greater uncertainty is introduced owing to the different physical conditions of materials in practice, and also to the length of time before materials of considerable thickness really arrive at a steady state with regard to the flow of heat, and thus come into the condition in which the coefficients determined as above are applicable. From his own measurements Mr. G. Voorhees stated that as much as six days was necessary, even with thicknesses of the order of a decimetre, before the conductivity was proportional to the thickness. Again, nearly all non-conducting walls are composite, either being built up by bricks or slabs, or in several layers with an air space between, or both combined. The conductivity is thus much more complicated, and it is very questionable whether any satisfactory conclusions could be arrived at without more complete investigation on these various questions.

On the production of cold there were several interesting papers describing the various methods used and summing up their efficiency.

New elements were introduced by the description of a novel rotating machine using sulphur dioxide, invented by M. Singrün. In this machine the outside of the hermetically closed condenser is kept in continual rotation, the inner parts being hung and kept in place by their weight. Some small machines were in actual work, and certainly produced ice very rapidly and easily with an apparently small consumption of power; but no figures were given or indicators used to show exactly what was happening. There seems no doubt that the principle is new and most useful for small machines, as there is little lubrication and no taps to get out of order. In the case of the usual compressors, considerable economy can be gained by the use of the multiple-effect method. In this case the same cylinder is used for two or more pressures at the same stroke by a proper system of ports and connections. The result is that the usual indicator diagram, which has a very sharp peak, for such machines, is much broadened there, and the same plant has thus a considerably higher working value.

The sections devoting themselves to the application of refrigeration to food were concerned with the construction of cold stores of all descriptions, about which there was nothing of general interest. The effect of different degrees of cold and humidity is being studied very carefully by the United States Department of Agriculture, and some of the results were given by Miss E. Pennington. Experiments on chickens varied in length from a few hours to four years, both on chickens bought in the open market and with those the history of which was known. It was found that, as would be expected, the various bacilli were more numerous in the former class, and their numbers appeared to increase up to about a year, and then to decrease. Even at the end of four years there were some living. These long periods are not often employed in practice, about five months being the average at present. Very interesting photomicrographs were exhibited showing the gradual breaking down of the muscles, owing to the intrusion of foreign matter which increased with the time. In some cases the breakage was sharply at right angles to the muscle, which rendered the material very brittle. The material was also examined chemically, the changes which occurred being much greater in the open market class, and all tend to prove that the action is due to enzymes and not to bacteria. The loss of water, though great, was not of any dietetic importance, though it would affect the commercial value, but this might be controlled to a large extent.

One interesting point was the occurrence of mould at the end of very long terms. There seemed no reason to suppose that the mould had appeared after removal from the cold store, as the time was so short before examination. This is important in connection with the present position of the authorities in England and France with regard to moulds, those on rabbits and meat being assumed to render them unfit for food, while they are allowed on hams, &c.

Similar investigations on a less elaborate scale, with other food-stuffs and either frozen ($-9°$ C. to $-12°$ C.) or chilled ($-1°$ to $-2°$ C.), were given by other investigators. The results point to the necessity of finding the most suitable temperature for each material and of care in thawing, and also of using pure water for this proceeding. Under modern conditions and for reasonable times, there seems to be no appreciable decrease in the nutritive effects of food materials due to refrigeration; in fact, many harmful parasites are less likely to be present in frozen than in unfrozen meat and other foods.

In the production of flowers for market it is of great advantage to be able to have them as early as possible. It appears that in many cases the time of flowering can be advanced nearly two months by checking the foliage at a critical time. The investigations are only in their infancy, but promise very important results.

The use of dry air is of importance in many industries at the present time, and the employment of considerable cold appears to be the most convenient and economical means of obtaining it. This is markedly the case in the production of pig-iron in the blast-furnace, where the usual amount of humidity in the air leads to a considerable loss. It is said that by reducing the humidity to 6 grains per cubic foot, an increase of output of 26·4 per cent. and a saving of fuel of 13·4 per cent. has been obtained.

In the section devoted to legislation it became clear how extremely important it now is to have united effort in refrigeration matters, and its great importance to the British Empire was emphasised. In view of this importance it is remarkable, and entirely characteristic, that the British Government, in marked distinction to other countries, paid no attention to the congress.

In addition to the sectional meetings, congress lectures were given by Profs. von Linde and d'Arsonval. The former enlarged on the use of cold in dwelling houses, and took as his text the saying that the use of cold would advance civilisation in the tropics in a manner similar to that in which the temperate regions had been advanced by the employment of means of heating. Prof. d'Arsonval lectured on the science and industry of cold, reviewing our present position, and in this way closed a successful congress, in which nearly 4000 people, drawn from the whole world, took part.

It was decided to hold the next congress at Vienna in 1910, after which they will be triennial.

LOCAL ASSOCIATIONS FOR PROMOTING EUGENICS.[1]

I PROPOSE to take the present opportunity of submitting some views of my own relating to that large province of eugenics which is concerned with favouring the families of those who are exceptionally fit for citizenship. Consequently, little or nothing will be said relating to what has been well termed by Dr. Saleeby "negative" eugenics, namely, with hindering the

[1] Address to a meeting of the Eugenics Education Society at the Grafton Galleries, on October 14 by Francis Galton, F.R.S.

marriages and the production of offspring by the exceptionally unfit. The latter is unquestionably the more pressing subject of the two, but it will soon be forced on the attention of the legislature by the recent report of the Royal Commission on the Feeble-minded. We may be content to await for awhile the discussions to which it will give rise, and which I am sure the members of this society will follow with keen interest, and with readiness to intervene when what may be advanced seems likely to result in actions of an anti-eugenic character.

The remarks I am about to make were suggested by hearing of a desire to further eugenics by means of local associations more or less affiliated to our own, combined with much doubt as to the most appropriate methods of establishing and conducting them. It is upon this very important branch of our wide subject that I propose to offer a few remarks.

It is difficult, while explaining what I have in view, to steer a course that shall keep clear of the mud flats of platitude on the one hand, and not come to grief against the rocks of over-precision on the other. There is no clear issue out of mere platitudes, while there is great danger in entering into details. A good scheme may be entirely compromised merely on account of public opinion not being ripe to receive it in the proposed form, or through a discovered flaw in some non-essential part of it. Experience shows that the safest course in a new undertaking is to proceed warily and tentatively towards the desired end, rather than freely and rashly along a predetermined route, however carefully it may have been elaborated on paper.

Again, whatever scheme of action is proposed for adoption must be neither Utopian nor extravagant, but accordant throughout with British sentiment and practice.

The successful establishment of any general system of constructive eugenics will, in my view (which I put forward with diffidence), depend largely upon the efforts of local associations acting in close harmony with a central society, like our own. A prominent part of its business will then consist in affording opportunities for the interchange of ideas and for the registration and comparison of results. Such a central society would tend to bring about a general uniformity of administration the value of which is so obvious that I do not stop to insist on it.

Assuming, as I do, that the powers at the command of the local associations will be almost purely social, let us consider how those associations might be formed and conducted so as to become exceedingly influential.

It is necessary to be somewhat precise at the outset, so I will begin with the by no means improbable supposition that in a given district a few individuals, some of them of local importance, are keenly desirous of starting a local association or society, and are prepared to take trouble to that end. How should they set to work?

Their initial step would seem to be to form themselves into a provisional executive committee, and to nominate a president, council, and other officers of the new society. This done, the society in question, though it would have no legal corporate existence, may be taken as formed.

The committee would next provide, with the aid of the central society, for a few sane and sensible lectures to be given on eugenics, including the A B C of heredity, at some convenient spot, and they would exert themselves to arouse a wide interest in the subject by making it known in the district. They would seek the cooperation of the local medical men, clergy, and lawyers, of the sanitary authorities, and of all officials whose administrative duties bring them into contact with various classes of society, and they would endeavour to collect round this nucleus that portion of the local community which was likely to be brought into sympathy with the eugenic cause. Every political organisation, every philanthropic agency, proceeds on some such lines as I have just sketched out.

The committee might next issue, on the part of the president and council of the new society, a series of invitations to guests at their social gatherings, where differences of rank should be studiously ignored. The judicious management of these gatherings would, of course, require considerable tact, but there are abundant precedents for them, among which I need only mention the meetings of the Primrose League at one end of the scale, and those held in Toynbee Hall at the other end. Given a not inclement day, an hour suitable to the occasion, a park or large garden to meet in, these informal yet select reunions might be made exceedingly pleasant, and very helpful to the eugenic cause.

The inquiries made by the committee when they were considering the names of strangers to whom invitations ought to be sent, would put them in possession of a large fund of information concerning the qualities of many notable individuals in their district, and their family histories. These family histories should be utilised for eugenic studies, and it should be the duty of the local council to cause them to be tabulated in an orderly way, and to communicate the more significant of them to the central society.

The chief of the notable qualities, to which I refer in the preceding paragraph, is the possession of what I will briefly call by the general term of "Worth." By this I mean the civic worthiness, or the value to the State, of a person, as it would probably be assessed by experts, or, say, by such of his fellow-workers as have earned the respect of the community in the midst of which they live. Thus the worth of soldiers would be such as it would be rated by respected soldiers, students by students, business men by business men, artists by artists, and so on. The State is a vastly complex organism, and the hope of obtaining a proportional representation of its best parts should be an avowed object of issuing invitations to these gatherings.

Speaking only for myself, if I had to classify persons according to worth, I should consider each of them under the three heads of physique, ability, and character, subject to the provision that inferiority in any one of the three should outweigh superiority in the other two. I rank physique first, because it is not only very valuable in itself and allied to many other good qualities, but has the additional merit of being easily rated. Ability I should place second on similar grounds, and character third, though in real importance it stands first of all. It is very difficult to rate character justly; the tenure of a position of trust is only a partial test of it, though a good one so far as it goes. Again, I wish to say emphatically that in what I have thrown out I have no desire to impose my own judgment on others, especially as I feel persuaded that almost any intelligent committee would so distribute their invitations to strangers as to include most, though perhaps not all, of the notable persons in the district.

By the continued action of local associations as described thus far, a very large amount of good work in eugenics would be incidentally done. Family histories would become familiar topics, the existence of good stocks would be discovered, and many persons of "worth" would be appreciated and made acquainted with each other who were formerly known only to a very restricted circle. It is probable that these persons, in their struggle to obtain appointments, would often receive valuable help from local sympathisers with eugenic principles. If local societies did no more than this for many years to come, they would have fully justified their existence by their valuable services.

A danger to which these societies will be liable arises from the inadequate knowledge joined to great zeal of some of the most active among their probable members. It may be said, without mincing words, with regard to much that has already been published, that the subject of eugenics is particularly attractive to "cranks." The councils of local societies will therefore be obliged to exercise great caution before accepting the memoirs offered to them, and much discretion in keeping discussions within the bounds of sobriety and common sense. The basis of eugenics is already firmly established, namely, that the offspring of "worthy" parents are, *on the whole*, more highly gifted by nature with faculties that conduce to "worthiness" than the offspring of less "worthy" parents. On the other hand, forecasts in respect to particular cases may be quite wrong. They have to be based on imperfect data. It cannot be too emphatically repeated that a great deal of careful statistical work has yet to be accomplished before the science of eugenics can make large advances.

I hesitate to speculate farther. A tree will have been planted; let it grow. Perhaps those who may thereafter feel themselves or be considered by others to be the

possessors of notable eugenic qualities—let us for brevity call them "Eugenes"—will form their own clubs and look after their own interests. It is impossible to foresee what the state of public opinion will then be. Many elements of strength are needed, many dangers have to be evaded or overcome, before associations of Eugenes could be formed that would be stable in themselves, useful as institutions, and approved of by the outside world.

The suggestion I made in the earlier part of this paper that the executive committee of local associations should cooperate, wherever practicable, with local administrative authorities, proceeded on the assumption that the inhabitants of the districts selected as the eugenic "field" had a public spirit of their own and a sense of common interest. This sense would be greatly strengthened by the enlargement of mutual acquaintanceship and the spread of the eugenic idea consequent on the tactful action of the committee. It ought not to be difficult to arouse in the inhabitants a just pride in their own civic worthiness, analogous to the pride which a soldier feels in the good reputation of his regiment or a lad in that of his school. By this means a strong local eugenic opinion might easily be formed. It would be silently assisted by local object-lessons, in which the benefits derived through following eugenic rules and the bad effects of disregarding them were plainly to be discerned.

The power of social opinion is apt to be underrated rather than overrated. Like the atmosphere which we breathe and in which we move, social opinion operates powerfully without our being conscious of its weight. Everyone knows that governments, manners, and beliefs which were thought to be right, decorous, and true at one period have been judged wrong, indecorous, and false at another; and that views which we have heard expressed by those in authority over us in our childhood and early manhood tend to become axiomatic and unchangeable in mature life.

In circumscribed communities especially, social approval and disapproval exert a potent force. Its presence is only too easily read by those who are the object of either, in the countenances, bearing, and manner of persons whom they daily meet and converse with. Is it, then, I ask, too much to expect that when a public opinion in favour of eugenics has once taken sure hold of such communities and has been accepted by them as a quasi-religion, the result will be manifested in sundry and very effective modes of action which are as yet untried, and many of them even unforeseen?

Speaking for myself only, I look forward to local eugenic action in numerous directions, of which I will now specify one. It is the accumulation of considerable funds to start young couples of "worthy" qualities in their married life, and to assist them and their families at critical times. The gifts to those who are the reverse of "worthy" are enormous in amount; it is stated that the charitable donations or bequests in the year 1907 amounted to 4,868,050*l*. I am not prepared to say how much of this was judiciously spent, or in what ways, but merely quote the figures to justify the inference that many of the thousands of persons who are willing to give freely at the prompting of a sentiment based upon compassion might be persuaded to give largely also in response to the more virile desire of promoting the natural gifts and the national efficiency of future generations.

ZOOLOGY AT THE BRITISH ASSOCIATION.

The Rule of Priority in Zoological Nomenclature.

MR. G. A. BOULENGER expressed disapproval of the extreme application of the rule of priority in zoological nomenclature on the ground that it had already produced much mischief under the pretence of arriving at ultimate uniformity. The worst feature of the abuse of this rule is not so much the bestowal of unknown names on well-known animals as the transfer of names from one to another, as in the case of Astacus, Torpedo, Holothuria, Simia, Cynocephalus, &c., so that the names which were uniformly used by Cuvier, Johannes Müller, Owen, Agassiz, Darwin, Huxley, and Gegenbaur would no longer convey any meaning; very often they would be misunderstood, and the very object for which Latin or Latinised names were introduced would be defeated. While considering uniformity in the future, it was surely important to have some consideration for the past; the speaker suggested that names with which all general zoologists are familiar should be protected from the revisers of nomenclature, and that it might be possible for committees to be appointed to determine, group by group, which names are thus to be respected, not necessarily on the ground of their earliest date or their correct application in the past, but as having been universally used over a long period in a definite sense. Mr. Boulenger's proposals were supported by several subsequent speakers, and the section agreed that a resolution, in the sense of and containing the manifesto published in NATURE, vol. lxxviii., p. 395, be communicated to the principal British zoological societies, to Section C, and to the British representative on the committee of nomenclature of the International Congress of Zoology.

The Determination of Sex.

A discussion, jointly with Section K, on the determination of sex, was opened by Mr. L. Doncaster. After briefly reviewing some of the recent work on the nucleus in this connection, he proceeded to describe a series of breeding experiments with the moth *Abraxas grossulariata* and the rare variety *lacticolor*, and concluded that the explanation of the results which he had obtained must be as follows:—(1) the sex determinants behave as Mendelian characters, maleness and femaleness being allelomorphic with one another, and femaleness dominant; (2) all females are heterozygotes, carrying recessive maleness, and producing male-bearing and female-bearing eggs in equal numbers; all males are homozygous, carrying only maleness and producing only male-bearing spermatozoa; (3) the *grossulariata* character cannot be borne by a female-bearing gamete.

Mr. W. Heape insisted that external circumstances, such as nutrition and general metabolism, could alter the proportion of the sexes in the young born.

Miss N. M. Stevens described her work on the spermatogenesis of several insects, devoting particular attention to the heterotropic chromosomes, in regard to which she confirmed Wilson's conclusions.

Prof. Bateson described Miss Durham's experiments with the cinnamon canary. When a cinnamon male is paired with a green female, all the males are cinnamon and the females green, but when a cinnamon female is paired with a green male all the offspring, of both sexes, are green. He then proceeded to consider a similar but less simple case, investigated by himself and Mr. Punnett, namely, the silky fowl, in which two pairs of allelomorphic characters are concerned in addition to the sex determinants. Both these cases are explicable on similar lines to those suggested for Abraxas. He gave instances of sex-limited inheritance, such as colour-blindness and hæmophilia in man, in which the males are affected and can transmit, while unaffected males cannot, but unaffected females may do so, the explanation being that the disease is dominant in the male and recessive in the female.

Dr. Copeman mentioned experiments which seemed to suggest that chemical factors may be important in sex determination, and a subsequent speaker referred to some sixty cases of old hen pheasants assuming male plumage as supporting the view that here it is the female which is heterozygous in sex, the male being homozygous, as no case of a male bird assuming female plumage was met with.

Account of the Recent Expedition to Lake Qurun.

Dr. W. A. Cunnington gave an account of the results of the investigation, by Mr. C. L. Boulenger and himself, of the Birket el Qurun in the Fayum province of Egypt. The lake, though still of considerable size—twenty-five miles long and five or six miles in maximum breadth—is much smaller than formerly; raised beaches are seen in many parts, and the water is shallow (nowhere more than 4 to 5 fathoms deep) and brackish. The lake was found to be well stocked with animal life, although the