an ingot have solidified, and even that information is of some importance.

Sir Robert Hadfield's method for producing sound ingots consists in producing solid "piping" steel, and then arranging matters in such a way that the tendency to form a pipe is neutralised by a full supply of hot liquid steel from above. This is attained by attaching to the top of the ingot-mould a "feeding head" lined with sand; this practically constitutes an upward continuation of the ingot-mould, and when the mould is filled the steel is allowed to rise to some distance into this attachment. The steel in this feeding-head is, however, to be kept molten until the solidification of the ingot proper is completed, and this is attained in Hadfield's process by covering the surface of the steel first with a thin layer of cupola slag, which serves to protect the metal against both thermal loss and chemical contamination, and then with a layer of charcoal, which is brought into a lively incandescence by the action of a blast of compressed air. The author gives numerous examples and full particulars of results attained in this way, and although in the discussion on this subject doubts were expressed as to the practicability of the process, and to some extent as to its novelty, its efficacy was admitted.

Another method intended to serve the same purpose of producing sound ingots was described by Dr. Hans Goldschmidt, who claims for it favourable results with thousands of actual ingots. This method consists in the introduction into the central, fluid part of a partially solidified ingot of a cartridge of "thermit." The amount of thermit used is small—about one pound per ton of steel—so that the heat generated is strictly local and quite negligible. The introduction of the thermit cartridge, which consists of an iron canister pushed down with an iron rod, results in a boiling or frothing up, followed by a settling of the steel in the mould, this shrinkage being made good by the addition of a further small amount of molten steel from the ladle. The author suggests that the thermit reaction taking place near the bottom of the solidifying ingot results in the removal of gas and of entangled slag, but this point of view was not at all appreciated in the discussion; in fact, Dr. Goldschmidt's proposals were scarcely taken seriously. Thus Stead suggested that the addition of a small amount of aluminium to the steel in the ladle would produce the same effects—a suggestion strongly repudiated by Goldschmidt. In view of the large amount of practical evidence brought forward in the paper, this treatment was a little surprising.

In the course of the discussion on these papers, Dr. J. E. Stead described a method introduced by Talbot for the production of sound ingots. In this process the ingots are passed through the "cogging mill" before their interior portions have become solid, and in this way the wider end of the ingot is compressed and the liquid steel is forced to fill up any shrinkage cavities which might be in course of formation. In principle this process is similar to the Harmet method of compressing steel ingots during their solidification, but if it proves to be practicable to handle and lightly roll ingots consisting of molten steel with a mere external crust of solidified metal, the method may justify the enthusiastic predictions of its sponsor. Talbot's own account of his procedure, with the statistical data demanded by Hadfield, will, however, be awaited with interest.

Among the more scientific papers which were taken as read at the meeting, the most interesting from the general point of view is that of Benedicks on allotropy in general and that of iron in particular. In this paper the author begins by raising the question whether allotropic or polymorphic changes are necessarily sudden, *i.e.* whether they must occur at one definite temperature or whether they may in certain cases occur continuously over a certain range of temperatures. He arrives at the latter conclusion, and expresses it by saying that all degrees of mutual solubility of the two allotropic modifications in one another are theoretically possible. In the case of a considerable mutual solubility an allotropic "transformation point" would cease to exist, but where the solubility is one-sided, the modification ii. being slightly soluble in the modification i., but not *vice versa*, there would be a gradual change upon one side of the transformation point with a large sudden change at that point itself. By means of accurate dilatometric measurements on silver iodide, Benedicks shows that the transformation of this body is of the type just indicated, the curve of dilatation giving the precise shape required on the assumption that the high-temperature modification is to some extent soluble in the low-temperature modification at temperatures just below the transition point, the solubility decreasing with falling temperature. This accounts for the negative dilatation at room temperatures.

When this view is applied to the case of iron, the author considers that the critical point at or near 890° C. is a definite allotropic change-point, but he does not regard beta iron as a separate allotropic form, explaining the existence of the beta range on the basis that gamma iron is soluble in alpha iron to an extent which increases with the temperature until the critical point is reached. Benedicks considers that this view would greatly simplify the metallography of iron, since it would reconcile the three theories now accepted as most probable regarding the nature of martensite. This interesting paper would undoubtedly have given rise to one of those spirited discussions for which this particular subject is noted, and it is a pity that so important a communication should have been passed over; it may be hoped, however, that it will receive full attention in the discussion by correspondence which forms so interesting a feature of the Journal of the institute.

HEREDITY AND EUGENICS.

THE third and last number of *The Mendel Journal* contains an interesting article on the alternative heredity of mental traits, by Dr. Frederick Adams Woods, of the Massachusetts Institute of Technology. Dr. Woods's previous studies of heredity as exemplified in Royal families attracted a great deal of attention, and the present short paper based on the same class of material is well worthy of study. He advances the argument that the contrasts shown in the characters of children born of the same parents and brought up in the same environment are evidence for, and not against, the inheritance of mental traits. Those who would insist, as many do, that psychical characters are wholly the expression of the environment will find these contrasts very difficult to explain, but to their opponents who attribute the preponderating influence to heredity they present no difficulties, since the possibility of alternative inheritance has never been disputed. Among the other contents of the number is an article on primitive eugenics, by Mr. E. Torday, in which the eugenical value of the customs of certain central African tribes is pointed out and their good effects described.

The American Eugenics Record Office was founded in 1910, and is now well established in a career of useful activity. Among its latest publications is Prof. C. B. Davenport's "Trait Book" (Bulletin No. 6).

The main object of this work is to provide an indexed and classified list of mental and physical traits to assist, by enlarging their vocabularies, the "field-workers" employed by the office in the collection of data for the study of inheritance in man. A decimal system of classification is adopted. Simple numbers denote the primary classes and additional numbers are added to represent successive stages of subdivision; for example, 4 stands for mental traits, 45 special abilities, 459 special ability for athletics, 4595 for ball playing, and 45954 for golf. The classification does not appear to be always logical; thus after 46 is written "egoistic (temperament)," and after 4622 "optimism *vs.* pessimism," something different in kind to, and not a subvariety of, egoism. Not only field-workers, but others, even lexicographers, will find in this pamphlet additions to their vocabularies, but it is doubtful whether many will desire to use such words as "unanecdoteness" or "unconversationableness." Further, we would question the propriety of contrasting "ludicrousness" with "absence of sense of humour," as a sense of humour is the faculty which most effectively enables one to avoid being ludicrous. But though these and other criticisms might be made, the work is one of undoubted utility, and will no doubt be greatly improved in future editions.

E. H. J. S.

INFLUENCE OF GEOGRAPHICAL CONDITIONS UPON JAPANESE AGRICULTURE.

IN a paper read recently before the Royal Geographical Society, Miss E. C. Semple discussed, largely on the basis of personal observation, a number of interesting features in the influence of geographical conditions upon Japanese agriculture. Premising that islands, with climates rendered equable by marine influence, and with the further advantage of supplying "the double larder of land and sea," offer specially favourable conditions for the early development of civilisation, she showed that agriculture in such circumstances quickly becomes intensive owing to the demand of an expanding population upon a cultivable area which, being insular, is not capable of expansion. This condition is particularly marked in Japan, because to its insular character are added other contributing causes. Cultivation and settlement are rare above about 2300 ft. of elevation. Forests and barren highlands above this height clearly segregate the densely populated valley-settlements, which cling closely to the rivers and streams, where rice, the staple crop, may receive the necessary irrigation.

Moreover, it is not merely what may be termed the mechanical facilities for this cultivation which limit its distribution. The generally unfertile character of the soil has also to be taken into account. Miss Semple quoted the present percentage of arable land to the total area of Japan proper as only 14·37, and proceeded to show that so far as statistical data are available, only Finland, Sweden, and Norway show a smaller percentage, and these, unlike Japan, are sparsely populated countries. The reclamation of the unfertile and ill-watered wastes, and the diversification of crops, are beyond the means of the Japanese smallholder, though a few rich farmers or companies have undertaken such work.

In dealing with the fertilisation of the soil, Miss Semple adverted to "the practical absence of stock-raising." It has been sought to attribute this peculiar feature to the principles of the Buddhistic faith, but Miss Semple prefers to find its reason in the scarcity of natural pasturage or fodder-plants. She dealt at some length with the two classes of wet and dry fields characteristic of Japanese agriculture, together with the geographical effect of relief upon their distribution; on the other hand, she showed that the terrace system of cultivation usually associated with mountainous tracts alone is not so in Japan, because the irrigation of the lowland rice-fields also involves it. The raising of the silk-worm is found to be practically confined to inland provinces, and largely to upland farms, where communications are bad, and the natural tendency has been to develop a product of small bulk (and therefore easily conveyed) and high proportional value.

CHEMISTRY AT THE BRITISH ASSOCIATION.

THE Chemical Section may claim a fair share in what has proved to be a record year for the Association generally, and although the counter attractions of the International Congress had some effect on the attendance of the senior chemists, the section room was better filled than has sometimes been the case of late years. In particular Prof. Divers was greatly missed; for many years there has been no more regular supporter of the Association.

Whilst the plan adopted of grouping communications more or less under four main headings had the result that, as regards quality, the discussions were the best for some years past, this plan has the disadvantage that it tends to emphasise the very special nature o the subjects considered. The type of paper presented was satisfactory: brief summaries of the field rather than detailed accounts of method and results were the rule, and in consequence the task of the president in keeping to the time table was a light one.

The daily Press is apt to criticise the work of the section as too technical, but it must not be forgotten that the problems which chemists are now engaged in studying are essentially of a fundamental character. Dundee will perhaps be remembered as the "origin of life" meeting, and though the discussion on this subject was confined to the biologists, both in this discussion and in Prof. Schäfer's address it was admitted that chemical science must be looked to ultimately for light on the problems of life.

In acquiring accurate knowledge of the carbohydrates, fats and proteins, or of the properties of colloids, or in the study of enzymes and cell activators of all kinds, the chemist has already amassed a greater store of exact knowledge of biological import than is generally realised. Though he is forced at present by their very complexity to surround his conceptions in the technicalities of a nomenclature, which to the initiated is unique in its expressive simplicity, the day is not far distant when a more popular summary will be possible—indeed, only this year the announcement has been made of the success of nutrition experiments carried out entirely with synthetic food, every ingredient of which can be built up chemically from the elements.

The proceedings on Thursday, September 5, opened as customary with the presidential address, which has already appeared in full, the rest of the morning being devoted to physical papers. Prof. H. Marshall described the interaction between thiocarbamide, iodine and sulphur. Mr. A. J. Berry dealt with the distillation of binary mixtures of metals *in vacuo*, and described experiments showing that copper and cadmium are quantitatively separable by volatilisation of the cadmium, whereas magnesium and cadmium yield a non-homogeneous distillate. The compound $MgZn_2$ can be prepared by distilling alloys containing an excess of zinc beyond this composition; the excess of zinc volatilises.