SOLIDIFICATION OF METALS.

THE first Report to the Beilby Prize Committee of the Institute of Metals on "The Solidification of Metals from the Liquid State," by Dr. C. H. Desch, is published in the current number of the Journal of the Institute. It consists of a very interesting and comprehensive review of the literature bearing on the subject, in conformity with the first part of the scheme of Dr. Beilby, which included both the preparation of a summary of the existing knowledge on the subject of the solidification of metals and an experimental investigation of certain parts of the subject. The report deals first with the cellular structure of metals, and it is shown that more than one apparently cellular structure may be detected in metals under suitable conditions. The crystallisation of metals is next approached, and the formation of crystallites or crystal skeletons. Attention is very rightly directed to the few opportunities which occur for the goniometrical and physical study of isolated crystals of metals. For there can be no doubt that much valuable information would be obtained from such an investigation, which would also be of particular value as throwing light on the phenomenon of hardness. In a solidifying metal crystallites start at numerous independent centres, and each grows as a crystal until interfered with by its neighbours, which interference gives rise to the so-called "allotriomorphic" formations of irregularly bounded crystals.

The foam-structure theory of Quincke is next dealt with, and shown to be carried much too far in its application to metals; for the theory affords no explanation of the absolutely firmly established geometrical properties of crystals. Cellular structures in cooling liquids are next described, and then comes a most interesting section on liquid crystals, in which it is pleasant to see that Dr. Desch gives full credit to the marvellously detailed work of Lehmann, who has now established it beyond doubt that there are substances, usually organic, which unite the properties of a crystal and a liquid, and that a definite arrangement of the molecules may persist in the liquid state.

The influence of surface tension is then discussed, and the existence of a metastable limit in the case of undercooling, together with the phenomenon of change of volume on solidification. Finally, the possibility of a thrust being exerted by growing crystals is debated from the evidence available, and the fact pointed out that there is yet no clear evidence of any effect which cannot be attributed to change of volume during change of state. The net result of the report is to indicate the immense field open for investigation, and one which has bearings, not only on pure science, but on industrial problems of the greatest importance and magnitude.

THE AUSTRALIAN MEETING OF THE BRITISH ASSOCIATION.

INAUGURAL ADDRESS BY PROF. WILLIAM BATESON, M.A., F.R.S., PRESIDENT.

PART II.—SYDNEY.

AT Melbourne I spoke of the new knowledge of the properties of living things which Mendelian analysis has brought us. I indicated how these discoveries are affecting our outlook on that old problem of natural history, the origin and nature of species, and the chief conclusion I drew was the negative one, that, though we must hold to our faith in the evolution of species, there is little evidence as to how it has come about, and no clear proof that the process is continuing in any considerable degree at the present time. The thought uppermost in our minds is that knowledge of the nature of life is altogether too slender to warrant speculation on these fundamental subjects. Did we presume to offer such speculations they would have no more value than those which alchemists might have made as to the nature of the elements. But though in regard to these theoretical aspects we must confess to such deep ignorance, enough has been learnt of the general course of heredity within a single species to justify many practical conclusions which cannot in the main be shaken. I propose now to develop some of these conclusions in regard to our own species, Man.

In my former Address I mentioned the condition of certain animals and plants which are what we call "polymorphic." Their populations consist of individuals of many types, though they breed freely together with perfect fertility. In cases of this kind which have been sufficiently investigated it has been found that these distinctions—sometimes very great and affecting most diverse features of organisation—are due to the presence or absence of elements, or factors as we call them, which are treated in heredity as separate entities. These factors and their combinations produce the characteristics which we perceive. No individual can acquire a particular characteristic unless the requisite factors entered into the composition of that individual at fertilisation, being received either from the father or from the mother or from both, and consequently no individual can pass on to his offspring positive characters which he does not himself possess. Rules of this kind have already been traced in operation in the human species; and though I admit that an assumption of some magnitude is involved when we extend the application of the same system to human characteristics in general, yet the assumption is one which I believe we are fully justified in making. With little hesitation we can now declare that the potentialities and aptitudes, physical as well as mental, sex, colours, powers of work or invention, liability to diseases, possible duration of life, and the other features by which the members of a mixed population differ from each other, are determined from the moment of fertilisation; and by all that we know of heredity in the forms of life with which we can experiment we are compelled to believe that these qualities are in the main distributed on a factorial system. By changes in the outward conditions of life the expression of some of these powers and features may be excited or restrained. For the development of some an external opportunity is needed, and if that be withheld the character is never seen, any more than if the body be starved can the full height be attained; but such influences are superficial and do not alter the genetic constitution.

The factors which the individual receives from his parents and no others are those which he can transmit to his offspring; and if a factor was received from one parent only, not more than half the offspring, on an average, will inherit it. What is it that has so long prevented mankind from discovering such simple facts? Primarily the circumstance that as man must have *two* parents it is not possible quite easily to detect the contributions of each. The individual body is a *double* structure, whereas the germ-cells are *single*. Two germ-cells unite to produce each individual body, and the ingredients they respectively contribute interact in ways that leave the ultimate product a medley in which it is difficult to identify the several ingredients. When, however, their effects are conspicuous the task is by no means impossible. In part also even physiologists have been blinded by the survival of ancient and obscurantist