museum, where local experts provided a full programme. Mr. R. Etheridge commented on various ethnological exhibits from Australia and New Guinea, being part of the rich collection over which he presides. Mr. S. A. Smith dealt with various anatomical peculiarities of the Australian aborigines. Messrs. Flashman, Hedley, Enright, and Elmore were also to thank for interesting contributions and exhibits, while a great debt is due to Prof. J. T. Wilson, who, despite the severe duties of military censor, managed to arrange for so strongly supported and well-organised a sectional meeting as that of the anthropologists at Sydney.

It has proved quite impossible to do justice here to the multitudinous experiences which, altogether apart from the formal proceedings of the section, have served to make the Australian visit of the association, and of the anthropologists in particular, at once pleasant and profitable in a quite unique way. The unfailing kindness and hospitality shown by our overseas brethren one and all make it a too invidious task to assign special thanks, and it must suffice, by way of showing due gratitude, to see to it that, in the way of science, Australia's myriad wonders and excellences are henceforth rated at their proper worth. As for the anthropologists in particular, they cannot be accused of having neglected Australia, since it has ever been the happy hunting-ground of the theorist seeking to reconstitute the life of primitive man; but at any rate it is likely that henceforth the study of Australian problems will proceed more intensively, inasmuch as the astonishing wealth of the Australian museums has been realised from near at hand. Moreover, we come away feeling that we have left on the spot plenty of men capable of carrying out the best kind of anthropological work, if only those in control of ways and means can be induced to make proper provision for a branch of study in which Australia might well aspire to lead the world.

THE IRON AND STEEL INSTITUTE.

ONE of the most noteworthy of the papers which was to have been presented at the Paris meeting, abandoned on account of the war, describes a new method of heating blast-furnace stoves. It appears from experiments on a stove carried out at the Neunkirchen works of Messrs. Stumm Brothers that, in their ordinary practice, of the total heat put into the stove about 26 per cent. was carried away in the waste gases and 18 per cent. was lost by radiation. Accordingly the efficiency of the stove was not more than 56 per cent.

As the author, Dr. Spannagel, points out, it is almost the universal practice to heat the stove for three to five hours and then send the blast through for one to one and a half hours. Messrs. Pfoser and Strack set themselves the task of finding out why the chequer work gives up its heat to the blast in a so much shorter time than is required to collect the heat from the waste gases, and they found that it was due to the fact that the velocity of the gases is different in the two cases. Under present conditions, when the temperature of the stoves is required to be raised the velocity of the gas is increased, and this causes the temperature of the waste gas to rise. Hence the waste gas losses are increased and the efficiency is reduced. The experimenters found, however, that this rule only holds up to a certain point, and that if the velocity is increased still further the temperature of the waste gas not only ceases to rise but begins to fall. The reason for this is probably that with a low velocity gas the molecules flow almost parallel to each other and the friction with the bricks is inconsiderable and consequently it is only the molecules which flow close to the chequer brick which transmit their heat by direct contact, whereas the remainder impart their heat slowly by radiation. If now the velocity is increased to the usual extent, the friction of the gas molecules against the brick causes some eddying in the outer layer of gas, and the inner particles are partly drawn into movement. The heat transmission is more rapid, but since the gas velocity is greater more heat is carried off unused. By raising the velocities still more the friction between the gas molecules and the brick becomes so great that the particles rebound and impart their rapid movement to those even in the centre of the current. Accordingly, the violent eddying produced brings all the molecules rapidly in contact with the chequer brick, and they give up their heat rapidly. Hence the temperature of the waste gas falls. The principle of the method, therefore, is precisely the same as that of the high-speed boiler designed by the late Prof. Nicholson, and indeed the authors say, "Experiments which have already been made in boiler firing have given particularly favourable results."

In heating the stoves the velocity of the gas is brought up to the necessary point by blowing in compressed air at a pressure of about 16 in. of water. At the first trial the heating period was reduced to 1½ hours, "the temperatures of the waste gases and of the blast being 350° C. maximum, and 800° C. respectively, as compared with the former heating period of 4½ to 5 hours, and a waste gas temperature of about 700° C. maximum, the blast temperature being the same." The experimenters have found it advantageous to use highly cleaned gas, since it enables the cross section of the heating passages to be reduced and the surface of the chequer brick to be substantially increased.

One of the outstanding problems, both of the iron-maker and the steel-maker, has always been the utilisation of the heat contained in slags. It is not so many years ago that the slags themselves were wasted. At the present day the uses of the various types of slags are many and various, but hitherto their sensible heat has been unutilised. Accordingly, the paper by Mr. W. L. Johnson, of Messrs. Bell Brothers, on this enormously important industrial problem, recording as it does the results of tests that have been in progress for four years, is well worth studying. The principle of the method has been to generate steam by allowing the molten slag to flow into a suitable generator and to utilise it in an exhaust steam turbine. In the first tests the steam was utilised direct from the generator, but these were abandoned in favour of an indirect method in which a water-heater and a heat exchanger were introduced between the primary generator and the turbine. The calandria used was a "Kestner single-effect climbing film evaporator," and consists of two parts, the calandria proper and the separator. A certain amount of sulphur was deposited, but there seems to have been very little corrosion of the tubes of the heater. A vacuum of about 9 in. of mercury was maintained in the separator so that the water boiled at 90–91° C. "With steam from the slag at 100° C. and keeping a temperature in the calandria of 91°, the mean of twenty-two experiments gave 173 gallons of water evaporated per hour, and the average steam per hour condensed in the calandria and heater was 190·2 gallons. The feed water entered the heater at an average temperature of 24·6° C., and entered the calandria at an average temperature of 89°, *i.e.* 91 lb. of clean water was evaporated for every 100 lb. of steam from the slag." The amount of available steam from the slag was determined by condensing and measuring it. Seven experiments gave as a mean 1017 lb. per ton of slag. Deducting 6·6 per cent. for escape with the incondensable gases, 950 lb.

remain, and 90 per cent. of this gives 855 lb. of clean steam available for the turbine. "Since modern exhaust steam turbines with a full load and a vacuum of 28½ in. can be guaranteed under the above conditions to use not more than about 27 lb. per horse-power, this gives 31·6 horse-power per hour per ton of slag per hour."

In his paper on the use of liquid ferro-manganese in the steel processes, Mr. Axel Sahlin points out most of the methods of adding ferro-manganese are wasteful both from the point of view of heat efficiency and the percentage of manganese oxidised. He describes a new type of arc furnace invented by Mr. Ivar Rennerfelt, which he claims has been successfully used for this purpose. This furnace is fitted with three electrodes so placed that, when the current is turned on, the arcs, instead of passing directly between the points of the electrodes are deflected downwards, forming an inverted arrow-head or "fleur-de-lys" with a height of 6 to 12 in. Adjustment is made so that the point of the "arrow-head" impinges on the surface of the metal. Manganese smoke was noticed for a few minutes after charging, but then ceased to be evolved. The tests which have been carried out indicate that for the melting of one ton of 79 per cent. ferro-manganese, charged into an empty and pre-heated furnace, about 450 units are required. This corresponds to a furnace efficiency of 78–79 per cent., and is very much better than anything that has been achieved with other types of electric furnace. Moreover, analyses showed that there was not only no loss of manganese and iron in the melting process, but even a gain of 0·6 per cent. in each case.

The industrial production of electrolytic iron now appears to be entering the "practical" stage. An account is given by Prof. Guillet of the manufacture of such iron in the form of tubes of considerable size. The direct production of sheets is also contemplated. The iron is deposited on a revolving kathode from a neutral solution of iron salts (the composition of which is not given), the electrolyte being maintained neutral by the circulation of the liquid over the surface of the iron. From time to time the liquid receives additions of iron oxide with the object of reducing the deposition of hydrogen on the kathode. In this way currents of 1000 amperes per square metre have been successfully employed, and an iron of excellent quality is said to have been obtained. Analyses show that it is very low in the usual impurities even when prepared from very impure pig-iron. When freshly prepared it is hard and brittle, partly on account of the fact that it has been deposited in a condition of strain and partly because it contains hydrogen. The former aspect is well seen in the photomicrographs, which reveal a typical martensitic structure, and it is interesting to observe that the normal polygonal structure of a pure metal is not obtained until the annealing has been carried to 800°–900° C. Photographs of the crushing tests of tubes indicate a very remarkable degree of plasticity. The direct production of sheets without rolling would certainly be an important technical achievement and such material on account of its high degree of purity would have important applications in electrical machinery.

H. C. H. CARPENTER.

PAPERS ON HEREDITY.

STUDENTS of heredity have followed with the greatest interest Dr. L. Doncaster's experimental and cytological work with the Magpie Moth (*Abraxas grossulariata*). In the last number of the *Journal of Genetics* (vol. iv, 1914, pp. 1–21, plates i–iii) he brings forward further interesting results on the relations between chromosomes, sex-limited transmission, and sex-determination in that insect. He confirms the observation that in a strain of Abraxas, which in each generation produces families consisting entirely of females, the oogonia have only fifty-five chromosomes instead of the fifty-six normal to the species. It is thus established that the females are here heterozygous as regards sex-character, whereas in many insects the males are known to be heterozygous. Dr. Doncaster found that one female of this remarkable strain carried fifty-six chromosomes, while other females of the same brood had clearly fifty-five. "In the same brood there was failure of sex-limited inheritance of the *grossulariata* character [as contrasted with the factor producing the variety *lacticolor*] in two cases, in such a way that the *grossulariata* mother transmitted this character to two of her daughters (out of a total of sixteen) instead of, as normally happens, only to her sons. It is suggested that this may be correlated with the extra chromosome found in one female of this family, the *grossulariata*-bearing chromosome having become separated abnormally from the sex-chromosome."

Another noteworthy recent paper on the problems of inheritance is Dr. Leon J. Cole's account of the relations of the principal colours in Pigeons (*Rhode Island State College*, Bulletin 158). He concludes that there are four principal factors concerned—two for the pigments black and red, an intensity and an extension factor. The absence of the intensity factor makes black dun and red yellow, while the absence of the extension factor produces blueness. "Reversion to the wild blue Rock Pigeon type in domesticated pigeons is due simply to a recurrence of the particular combination of factors which are present in *C. livia*." White plumage is explained by the presence of an unknown number of pigment-inhibiting factors which are supposed to check the appearance of colour on different regions of the body.

THE PLACE OF WISDOM (SCIENCE) IN THE STATE AND IN EDUCATION.[1]

"*So soon as men get to discuss the importance of a thing, they do infallibly set about arranging it, facilitating it, forwarding it, and rest not till in some approximate degree they have accomplished it.*"—CARLYLE.

THIS, doubtless, is a true statement; the difficulty is, however, to persuade men of the importance of a thing. We come to persuade you. As an association we are now eighty-four years old: our main purpose has been to obtain a more general attention to the objects of science and a removal of any disadvantages of a public kind which impede its progress—let me also add, its application to culture and to the public service.

By holding meetings, year after year, in the principal towns of the British Isles, the association has at least brought under notice the fact that science is a reality, in so far as this can be testified to by several hundreds of its votaries meeting together each year to consider seriously and discuss the progress of the various departments. On the whole, dilettanti have had little share in our debates. The association has already carried the flag of knowledge outside our islands, thrice to Canada and once to South Africa; now, at last, we make this great pilgrimage to your Australian shores; still we are at home. What message do we bring with us?

In 1847, when this city was but an insignificant town, it was visited by an Englishman who afterwards became eminent not only in science but also

[1] From an address to the Educational Science Section of the British Association at Melbourne, August 14, by Prof. Henry E. Armstrong, F.R.S.