with the implements of civilization, but have become degraded intellectually through isolation. Prehistoric discoveries, particularly those made in the region of Otaru, on the west coast of the island, favor this view. The pits found there for dwellings indicate that the Ainos came from the north to Yezo. The shell-heaps contain, besides very elegant potsherds, many stone implements, especially obsidian heads of lances and arrows, and ornaments of different kinds, as stone-beads and the like. In all these respects the shell-heaps are distinguished from those found throughout Japan, from latitude 39° north to the southernmost point of the coast of Kiushiu, within which limits the shell-heaps are destitute of ornaments, poor in stone implements, and entirely without obsidian. These facts point to a higher civilization of the Aino race, and at the same time refute the assumption that the Ainos formerly settled a large part of the main island (Nipon), — an assumption erroneously supposed by some to be supported by prehistoric discoveries. As there is no near relationship between the Ainos and the Giljaks of North Saghalien, who are less hairy, more prognathous, and more like the Tchuktchi race, we must assume that the Ainos were displaced by the Giljaks, and that their nearest relatives, judging from important analogies of language, and especially from their 'naturell,' are to be sought among the Kaoli of northern Corea (Oppert's Caucasian type of Koreans). The latter have symmetrical features and luxuriant beards, and are therefore called 'bearded barbarians' by the Japanese. They stand to the inhabitants of southern Corea in many respects as the Ainos to the Japanese. The Kaoli have had, to be sure, a history very different from that of the Ainos; for they became a civilized people, while the Ainos in the primeval forests of Yezo became more and more uncivilized. This fact is not opposed to the assumption of a kinship of the two races; and this assumption is supported not only by the particulars already alluded to, and the undeniable capacity of the Ainos for greater intellectual activity than they now exhibit, but also by the fact, that, notwithstanding the developed culture of the Coreans, certain things (e.g., the lance-shaped turrets on grave monuments) recur which remind one of Yezo. Besides, the traditions of the Kaoli, and certain names of places in the southern part of Amur (on the Sungari and its south-eastern tributaries), point to earlier dwelling-places of the race. From here the Ainos probably spread over the lower part of Amur and Saghalien. Other attempts to bring the Ainos and the North-Coreans into close relationship with other peoples are too hypothetical to require mention here. It is certainly to be hoped, but unfortunately it can hardly be expected, that the silent but eloquent appeal for friendly sympathy which the hearty greeting of the Ainos and the melancholy look given to strangers seem to make clear, may meet with some practical response: at all events, we should not withhold our most cordial good will from these sons of the primeval forests of our temperate zone, who are unquestionably the most peaceful and good-natured of all the so-called 'savages.'

THE HOT BLAST IN MAKING IRON.

At the last few meetings of the Iron and steel institute of Great Britain very important papers have been presented and discussed, showing the direction in which competition has brought about economy in iron-manufacture. These papers, notably those of Messrs. Cochrane, Hawdon, Bell, Cowper, and Howson, give to the technical reader a very good idea of the latest opinions of the foremost iron-makers of England.

The institute held its September meeting in Middlesborough, — the place in which it was organized fourteen years ago. This anniversary naturally led to some general reflections on the progress made in that time, which can be appreciated by the general public. The only drawback to the discussions was the absence, owing to illness, of Mr. I. Lowthian Bell, who has been present at all the previous meetings.

In 1828 Mr. J. B. Neilson patented a process for heating the air before it was blown into the blast-furnace, claiming that a gain in economy of working was the result. The idea was received with disbelief in most quarters. A little later Mr. Neilson proved conclusively to all that one hundred pounds of coal burned in heating the air for the blast were able to save three hundred to four hundred pounds of the fuel used within the furnace. The first step was made, and the iron-makers had to accept the consequences.

From this small beginning the tide of invention and enterprise went on, until the air used for blast was no longer heated by coal burned for the purpose, but by the combustion of what were formerly waste gases issuing from the top of the furnace. One improvement after another was introduced, until the temperature of the blast was raised to 900° F., and even to 1000° F. At this point it seemed that the metal pipes used in the stoves for heating had reached their limit of endurance; and a portion of the iron-making world made up their minds that greater heat than this could not be economically maintained, and that, even if the question of obtaining the heat was solved, there was still a balance of chemical reactions within the furnace which would prevent the greater heat from being advantageous.

Meanwhile, by the use of the Siemens regenerator principle, two different inventors, Cowper and Whitwell, each manufactured stoves which contained fire-brick chambers, within which the waste gases burned for a period, until the fire-bricks were at a red heat. The gases were then turned off to the alternate stove, and the air for the blast-furnace was driven in through the heated stove until the other one had become sufficiently heated. The interchange was again made, and so on. These various devices have resulted in the production of a blast of air for the furnace heated up to 1600° F., or even to 1700° F.

Now let us see what has been the result of this change. The blast-furnaces of 1869 produced, on an average, a little over 180 tons of iron per week. Today they produce, on an average, upwards of 300 tons per week, in some cases 800 or 900 (and in one of the Pittsburg furnaces the enormous output of 1,800 tons has been reached). Mr. Charles Cochrane, an advocate of the hottest hot blast, stated, that, at the works at Ormsby, they began in 1855 with a furnace of 7,000 cubic feet capacity, and with a temperature of air between that of molten lead and molten zinc, using 39.64 cwts. of coke to the ton of pig. In 1857 they used 33.87 cwts.; in 1867 it was only 29.66; in 1877 it had become reduced to 22.64; and in 1882, 21.18 cwts. was the average for all furnaces, small and large, while the larger furnace of 34,000 cubic feet capacity worked the whole year through on 19.38 cwts. per ton of pig. Hence from 1855 to 1883 the saving was 20.34 cwts. of coke per ton of iron; and, in Mr. Cochrane's opinion, fully half this saving was due to the use of the Cowper fire-brick stoves.

Mr. Cochrane has recounted some of the theoretical calculations that have been made. In 1879 he ventured to predict that a ton of iron could be made with 17.90 cwts. In 1881 he had made iron with 18.40 cwts. Another iron-master stated that a furnace has run for eight weeks on less than 18 cwts.

Mr. Hawdon claims that heating the blast from 990° F. to 1400° F. resulted in a saving of 1.5 cwts. of coke to the ton of iron, and that a further heating to 1550° F. was followed by a total saving of 2.5 cwts., bringing the coke down to 21.3 cwts.

In the discussions which took place at the meetings referred to, the prominent iron-manufacturers generally took the ground that the hotter the blast the better the result, up to the temperature of melting iron. Mr. I. Lowthian Bell, however, dissents from this view, and thinks, that, in real ultimate economy, 1000° F. will prove to be about the limit of heat for the blast which it is worth while to strive for.

R. H. RICHARDS.

MODERN PHYSIOLOGICAL LABORATORIES: WHAT THEY ARE AND WHY THEY ARE.[1] — I.

A LITTLE more than seven years ago I announced from this platform that the old biological laboratory was ready for use, — that set of rooms in the third story of this building, which, inconvenient in many respects as they were, will, I trust, always be remembered by some of us with affection, and mayhap with a little pride.

This night on which we have met to celebrate the completion of the new laboratory is, however, an occasion for looking forward rather than backward. But before proceeding to speak in detail of the new building, I feel sure I do but what every one of the members of the biological department present would think me remiss to omit, in pausing a moment to express our gratitude to those to whom we owe it, — first to our founder, Johns Hopkins, for his munificence; and next to his trustees. Probably very few present realize how much time and thought the trustees spent on the building before a stone of its foundation was laid, and during its erection. No one but myself knows how often I have been put in good heart by the cheering words, "Well, Dr. Martin, let us get it right when we are about it." In this connection I cannot refrain from saying, that, though we owe all so much, we owe a special debt of gratitude to Mr. Hall Pleasants, the chairman of the building committee. Throughout the whole summer there was hardly a morning on which he did not visit the building, and that not merely for a glance, but far more often to spend an hour or two hours about it, and make sure that all was going right.

The material result of this liberality, forethought, supervision, and care, is that stately building on the top of the hill. Handsome though not ostentatious, comfortable but not luxurious, pleasant to work in without unnecessary finery, it stands there, for its purpose unrivalled in the United States, and not surpassed in the world.

Substantial, solid, well thought out, suited to its ends, and with no frippery about it, it is now for us to see that our work agrees in character with the building.

There are many here to-night, who, not being biologists, may desire to know what such laboratories are for, and why there is any need of them. I shall perhaps best begin my attempt to answer these questions by stating briefly what our own laboratory is.

It is a building constructed primarily to afford facilities for instruction and research in physiology; and, secondarily, similar opportunities in allied sciences, as comparative anatomy and botany, some training in which is essential (and the more the better) to every one who would attain any real knowledge of physiology. As so many distinct branches of biological science are pursued in it, we call it in general the biological laboratory; but it is a biological laboratory deliberately planned that physiology in it shall be queen, and the rest her handmaids. If, therefore, you visit the building prepared to see a great zoölogical museum or an extensive herbarium, you will be disappointed. I do not underrate, and no one connected with this university can, — bearing in mind the brilliant anatomical researches of Dr. Brooks and others, made among us, — the claims of morphology; and in time I trust we may see a sister building specially designed for study of the structure, forms, and development of plants and animals. But one or the other had to be first chosen, unless we were to do two things imperfectly instead of one well, and there were strong reasons for selecting physiology. In the first place, I think even the morphologists will admit that hitherto, and especially in the United States, they have had rather more than their fair share; innumerable museums and many laboratories have been built for their use; while physiology, if she got any thing, was usually allotted some out-of-the-way room in an entirely unsuitable building, if

[1] An address delivered on the occasion of the formal opening of the new biological laboratory of the Johns Hopkins university, Jan. 2, 1884. By H. NEWELL MARTIN, M.D., Dr. Sc., M.A., professor of biology in the university.