Laurentian gneisses, and contrasted the slight metamorphism of the Lower Huronian conglomerates of Cobalt with their alteration into gneiss at Michipicoten by infolding with Keewatin batholites.

Dr. Lane stated the three possible sources of the gneissic rocks known as the Laurentian, and from a comparison of the size of their constituents with those of the adjacent rocks concluded that the Laurentians must be due to the ascent of deep-seated fluid material.

In the afternoon meeting various subdivisions of the pre-Cambrian rocks were advocated. Mr. W. G. Miller explained the classification used by the Geological Survey of Ontario, which adopts three main divisions: the Keweenawan for the upper sandstones, the Huronian for the underlying schists, quartzites, &c., and the Laurentian-Keewatin for the basal complex. Prof. Coleman objected to the retention of Laurentian except as a temporary convenience, since the Laurentian are intrusive rocks of various ages. Dr. Sederholm explained the classification he had adopted for Finland and Scandinavia, where the pre-Cambrian system is broken up by great unconformities into divisions, each of which he thought from its thickness must correspond to the groups, and not to the systems, of the post-Cambrian rocks. He objected to the germs previously used, and proposed to call the pre-Cambrian rocks the Progonozoic, and to divide them into three divisions, the Archeo-, Meso-, and Næo-progonozoic.

Another case of supposed Palæozoic schists proving to be pre-Cambrian was described by Prof. J. F. Kemp from evidence displayed during recent work for the New York water supply.

President van Hise supported the threefold division of the pre-Cambrians, and Mr. Fermor the twofold division found more convenient in India, and referred to Sir Thomas Holland's term Purana for the non-foliated pre-Cambrian sediments. Miss Raisin directed attention to the analogous case in the English Midlands, and to Lapworth's term Uriconian for the comparatively unaltered pre-Cambrian volcanic series.

The petrographic section, under the presidency of Dr. Teall, devoted a morning to discussion of the principles of rock classification. Prof. Adams exhibited photographs of the structures he had produced in rocks, including the formation of flaser gabbro or augen gneiss by pressure at temperatures of 450° F. No fresh minerals were produced, but by mechanical movements the material of a massive diabase was rearranged as a gneiss.

Prof. Vogt urged the claim of eutectics as a factor in rock classification. Dr. A. L. Day explained the aims and methods of the researches on mineral formation and stability conducted in the Carnegie Institute, and expressed confidence that their methods could in time be applied to even such complex mixtures as ordinary rocks.

Dr. Whitman Cross defended the quantitative system of rock classification from recent criticisms, and said that the other systems were only less arbitrary in the degree that they were less definite. He referred to Becke's petrographic types—the Atlantic and Pacific—as based on distinctions that could not be sharply defined. Dr. Evans repeated his criticisms on the quantitative system, and the general discussion was continued by Dr. Benett, Prof. Kœnigsberger, and Prof. Tschirwinsky.

Meetings of the other sections were devoted to tectonic geology, especially of Switzerland, to the causes of the Ice age, to polar geology, applied geology, stratigraphy, and palæontology.

At the final meeting it was decided that the next meeting, in 1913, should be in Canada, and the hope expressed that the meeting in 1916 should be in Belgium.

THE THOMAS YOUNG ORATION.

PROF. R. W. WOOD, in delivering the Thomas Young Oration at the Optical Society on Thursday, September 29, described some apparatus with which he has been experimenting recently. The first of these, which he calls the echelette grating, is an instrument occupying a position between the echelon and the ordinary diffraction grating. It is a grating ruled with a crystal of carborundum on gold deposited on copper; the carborundum has the advantage over a diamond point of having perfectly straight sides meeting at an angle of 120°. The spacing is about ten times as coarse as usual. No metal is removed in ruling, but the gold is compressed so as to form ridges and hollows. The sides of these ridges are highly polished and almost optically flat. Such a grating may have various faults, such as having a flat or irregular top to the ridges, or the sides of one groove may be deformed in ruling the next; tests to determine whether the grating is free from faults were described.

A variety of gratings is obtained by altering the position of the crystal in ruling; thus some gratings have their two sides equally inclined to the surface of the plate, and in others there are inequalities in the inclinations of various magnitudes. The gratings thus obtained, with a known form of groove, have been used to determine the causes which throw the greater part of the light of a definite wave-length into one particular spectrum. These gratings bear the same relation to heat waves that the ordinary diffraction grating bears to light waves; thus they are specially suitable for use in investigations into radiant energy, being many times more efficient than prisms of rock salt. Diagrams were shown which demonstrated the greater resolving power of the grating compared with the rock-salt prism. A number of gratings were exhibited, and some of the tests for detecting faults were shown. A demonstration was also given of the ability of these gratings to concentrate the light of a definite colour into a particular spectrum.

Prof. Wood next described his mercury telescope, in which the mirror is a vessel containing mercury, the surface of which is made to assume a steady parabolic form by rotation under gravity. The practical difficulties to be overcome in preventing ripples on the mercury surface due to vibration or to a very slight obliquity in the axis of rotation were described. The mercury vessel is mounted on an axis with two conical bearings, and the whole mount is placed on a stand with levelling screws. To avoid the excessive friction due to conical bearings, the greater part of the weight is taken by a steel ball under the centre of the objective. A magnetic drive was first attempted, but was abandoned in favour of a mechanical connection consisting of half a dozen fine threads of pure elastic, thus any vibrations in the motor are absorbed by the elastic threads. Some star trails taken with the instrument in and out of adjustment were described.

Finally, some photographs of landscapes taken with infra-red light were shown.

THE POLAR ESKIMOS.[1]

ANTHROPOLOGISTS are now beginning to realise the necessity of supplementing the methods of a general ethnographic survey by a more intensive study of smaller groups within limited areas. A good example of this class of investigation is provided by the account of the Polar Eskimos by Dr. H. P. Steensby, who was a member of the expedition commissioned by the Danish Missionary Society in 1909 to establish a station in Greenland.

The tribe known as the Polar Eskimos occupies the west side of the Hayes Peninsula, extending from north-west Greenland towards the west between the Kane Basin in the north and the Melville Sound in the south. At present they number about two hundred souls. Compared with the people of the more southerly west Greenland, they appear to be a different race, the Mongolian type prominent in the latter region being here replaced by that called by Dr. Steensby the Indian. The so-called Mongolian racial characters, the low nose, oblique eyes, flat face, broad and large cheek-bones, are more prominent in the women than in the men. The skull is of the dolichocephalic class. The skin has always a yellowish ground-colour, and the so-called "Mongolian spot" is present in the sacro-lumbar region of children.

Much of the existing culture of the tribe seems to be due to the emigration of a body of their kinsmen from the coasts of North Devon and Ellesmere Land in the early 'sixties, and they present the almost unique condi-

1 "Contributions to the Ethnology and Anthropogeography of the Polar Eskimos." By Dr. H. P. Steensby. Pp. 253—406. (Copenhagen: Bianco Luno, 1910.)

tion that during the comparatively short period since they came under European observation they have risen from practically the lowest to a comparatively high stage of culture. Kane, who in the early 'fifties first described them, found that they possessed little iron or wood, using sledge-runners of bone and pieces of barrel-hoops as knives. They did not hunt the reindeer, and were ignorant of the use of the bow and arrow; they could not catch salmon, and did not use the kayak. These cultural deficiencies were certainly survivals of their primitive social condition. During the 'sixties, however, they learned from emigrants from the American side of Smith's Sound the art of reindeer hunting, the use of the bow and arrow, skill in salmon catching, and the mode of building kayaks and hunting from them. The leader of this party of foreigners, Kridlarssuark, has now become the legendary culture hero. Finally, in 1891, Peary began his intercourse with them, which enabled them to obtain in exchange for their fox and bear skins the finest American weapons, with the result that the rapid destruction of game will probably soon destroy their main source of livelihood. Even up to the time of Peary's first visit stone knives and axes were in use, and they used to make rude implements with cutting edges of meteoric iron, the source of which was discovered by Peary during a later expedition in 1894. Even now they make their harpoon points of iron with a head-piece of bone, and they work iron with much skill with the files they used for the older material.

A similar course of evolution may be traced in the construction of their houses. In their original home they must have used whale-ribs for the support of the roof. Wood of sufficient span being now not procurable, they have, while retaining the primitive plan, adopted a new device for supporting the roof, planned on the model of the cantilever.

With this modern and fairly advanced culture the Polar Eskimo combines many savage characteristics. He is, says Dr. Steensby, "a confirmed egoist, who knows nothing of disinterestedness. Towards his enemies he is crafty and deceitful; he does not attack them openly, but indulges in back-biting; he will not meet his deadly enemy face to face, but will shoot or harpoon him from behind." They practise a rude form of justice. One man, because he was a notorious liar, was summarily killed by two chiefs, one of whom annexed the wife of the deceased.

We have said enough to show the interest and value of this account of a little known tribe. It is illustrated by characteristic sketches, the work of an Eskimo woman, which in style closely resemble the Bushman drawings recently published under the editorship of Mr. H. Balfour.

THE BRITISH ASSOCIATION AT SHEFFIELD.

SECTION I.

PHYSIOLOGY.

OPENING ADDRESS BY PROF. A. B. MACALLUM, M.A., M.B., PH.D., SC.D., LL.D., F.R.S., PRESIDENT OF THE SECTION.

THE record of investigation of the phenomena of the life of animal and vegetable cells for the last eighty years constitutes a body of knowledge which is of imposing magnitude and of surpassing interest to all who are concerned in the studies that bear on the organic world. The results won during that period will always constitute, as they do now, a worthy memorial of the intense enthusiasm of the scientific spirit which has been a distinguishing feature of the last six decades of the nineteenth century. We are to-day, in consequence of that activity, at a point of view the attainment of which could not have been predicted half a century ago.

This body of knowledge, this lore which we call cytology, is still with all this achievement in one respect an undeveloped science. It is chiefly—nay, almost wholly—concerned with the structural or morphological side of the cell, while of the functional phenomena our knowledge is only of the most general kind, and the reason is not far to seek. What little we know of the physiological side of the cell—as, for example, of cellular secretion, absorption, and nutrition—has only to a very limited extent been the outcome of observations directed to that end. It is in very great part the result of all the inferences and generalisations drawn from the data of morphological research. This knowledge is not the less valuable or the less certain because it has been so won, but simply because of its source and of the method by which we have gained it; it is of a fragmentary character, and therefore less satisfactory in our estimation.

This state of our knowledge has affected—or, to express it more explicitly, has fashioned—our concept of living matter. When we think of the cell it is idealised as a morphological element only. The functional aspect is not ignored; but we know very little about it, and we veil our ignorance by classing its manifestations as vital phenomena.

It is true that in the last twenty years, and more particularly in the last ten, we have gathered something from biochemical research. We know much concerning ferment or catalytic action, of the physical characters of colloids, of the constitution of proteins, and their synthesis in the laboratory promises to be an achievement of the near future. We are also in a position to understand a little more clearly what happens in proteins when, on decomposition in the cell, they yield the waste products, urea, and other metabolites, with carbon dioxide and water. Further, fats can be formed in the laboratory from glycerine and fatty acids, a large number of which have also been synthesised, and a very large majority of the sugars of the aldohexose type have been built up from simpler compounds. These facts indicate that some of the results of the activity of animal and vegetable cells may be paralleled in the laboratory, but that is as far as the resemblance extends. The methods of the laboratory are not as yet those of nature. In the formation of carbohydrates, for example, the chlorophyll-holding cell makes use of processes of the most speedy and effective character, but nothing of these is known to us except that they are quite unlike the processes the laboratory employs in the artificial synthesis of carbohydrates. Nature works unerringly, unfalteringly, with an amazing economy of material and energy, while "our laboratory syntheses are but roundabout ways to the waste sink."

In consequence, it is customary to regard living matter as unique—*sui generis*, as it were, without an analogue or parallel in the inorganic world—and the secrets involved in its actions and activities as insoluble enigmas. Impelled by this view, there are those, also, who postulate as an explanation for all these manifestations the intervention in so-called living matter of a force otherwise and elsewhere unknown, biotic or vital, the action of which is directed, according to the character of the structure through which it operates, to the production of the phenomena in question. Living protoplasm is, in this view, but a mask and a medium for action of the unknown force.

This is an old doctrine, but it has again made headway in recent years owing to the reaction from the enthusiasm which came from the belief that the application of the known laws of physics and chemistry in the study of living matter would explain all its mysteries. A quarter of a century ago hopes were high that the solution of these problems would soon be found in a more profound comprehension of the laws of the physical world. Since then there has been an extraordinary increase in our knowledge of the structure and of the products of the activity of living matter without a corresponding increase in knowledge of the processes involved. The obscurity still involving the latter appears all the greater because of the high lights thrown on the former. Despair, in consequence, has taken the place of hope with some, and the action of a mysterious force is invoked to explain a mystery.

It may be admitted that our methods of investigation are very inadequate, and that our knowledge of the laws of matter, seemingly comprehensive, is not at present profound enough to enable us to solve all the problems involved in the vital phenomena. The greatest factor in the difficulty of their solution, however, has been the fact that there has been a great lack of investigators specially trained, not only in biology, but also in physics and chemistry, for the very purpose of attacking intelligently such problems. The biologists, for want of such a