NOTES

ON THE MEETING OF THE BRITISH ASSOCIATION

At Birmingham, 1865.

From the Canadian Naturalist for December, 1865.

In approaching Birmingham from the west, the visitor learns to appreciate the appellation 'black country,' which has long been enjoyed by the Staffordshire coal districts and their neighborhood. The smoke of hundreds of collieries and furnaces and foundries darkens the air; the green fields give place for miles together to piles of coal, cinders and ashes; and in some places the eye can discern, as far as the murky atmosphere will allow it to penetrate, no green thing. In the day, the aspect of the land is dark and lowering; in the night it brightens with the glow of innumerable furnace fires. It is a pity that the green face of nature cannot be preserved where men toil to extract wealth out of the bowels of the earth; but when both ends cannot be secured, the greater number of people can be supported by thus defacing the aspect of nature. The black country is thus, by virtue of its coal and iron, densely populous, greatly thriving, and a chief abode of manufacturing industry and wealth. All this centres at Birmingham, where the solid material of iron is made the basis whereon is built a vast variety of workmanship, in all sorts of implements and ornaments.

Birmingham itself is rather at the outskirts of the proper black country, on the red sandstone and conglomerate which overlie the coal field. The environs of the town, in consequence, are in some parts very beautiful, and adorned with numerous seats of the wealthy citizens, whose hospitality was extended most liberally to the members of the British Association. Birmingham is not only a great seat of many interesting manufactures, but is in the very heart of England, and in the midst of a network of railways so complicated as almost to puzzle the stranger desirous of visiting it. It has besides some excellent public edifices, well adapted to the meetings of a scientific parliament, more especially its new Town Hall, and the buildings of the Midland Institute and of King Edward's School. Hence the British Association has thrice met at Birmingham, and the success of its last meeting may well induce it to meet there again, should it have opportunity.

The British Association has now attained the mature age of thirty-five years. Its initial meeting at York assembled mainly through the instrumentality of Prof. Phillips; and this eminent geologist, who also presided at the Birmingham meeting, has, as Secretary of the Association, been its most active promoter during its whole existence. At a luncheon given to the members by the Mayor of Birmingham, Sir Roderick Murchison, who calls himself one of the 'Palæozoic members,' thus alluded to its origin:

"In the year 1831, when he was President of the Geological Society of London, his young friend of that day, one John Phillips of York—with whom and his distinguished uncle, the father of English geology, he had previously worked along the coasts of Yorkshire—wrote to him in London, encouraging him to promulgate a proposition which he had, by direction of that most eminent man, William Harcourt, sent up for their consideration. He endeavored to the best of his ability to carry out the wishes of his friend, but what was the result? He could get scarcely anybody to hear of the matter when he first laid it before them, and he could get none to accompany him save his friend Mr. Greenhow, of the Geological Society, and the late Mr. John Taylor. But though London did not respond, Manchester answered to the call, and sent that most eminent philosopher, Dalton; Ireland sent the Provost of Trinity, Dr. Lloyd; and Scotland was represented by Brewster, and one who had been at that meeting—Professor Forbes, the eminent mathematician. Cambridge was not represented; but from Oxford came Dr. Daubeny, with an invitation to the Association to meet there on the following year. Next year they met under Buckland at Oxford, and they had with them the most eminent scientific men of the day."

Since that time the Association has grown to be one of the great institutions of England. Peripatetic and without local habitation, essentially free and easy in its management, loose in its regulations, and democratic in its character, it is the most popular of British scientific societies. Its meetings attract thousands of auditors, and its influence, by the wide circulation given to its proceedings through the press, is felt throughout all parts of the British Empire.

The British Association is by no means to be viewed as a scene of scientific dissipation. Nor must its utility be regarded as confined merely to the diffusion of popular information, though this is no small or despicable use. It has important uses to the

cultivators of science themselves. It drags them out of their dens, and brings them face to face with each other and with the world. It gives scope for a free and open interchange of ideas and arguments. It makes those who have attained to high positions, acquainted with the humbler workers in their several spheres. It gives the younger men opportunities of coming forward into notice. It throws those who are the oracles of little coteries at home into the wider competition of the world. It enables scientific men in general better to appreciate the work of each other, and to form more accurate notions of the powers and modes of thought of fellow laborers. It affords excellent opportunities for bringing out new facts and discoveries, under circumstances which give the means of testing their real value, and, if they pass this ordeal, of giving them general currency.

To a student of science, whose ordinary sphere of labor is at a distance from the great centres of scientific work, and who can but rarely have conference with men engaged in similar pursuits with himself, these meetings are particularly valuable, and their value is enhanced by the rarity of opportunities for enjoying them. In our day the aspects of science rapidly change, and the student who depends for his information regarding them on books and on scientific journals, has, after all, but a faint impression of the newer phases of scientific enquiry. On attending the meeting of the British Association at Birmingham, after a lapse of ten years, I had forcibly presented to my mind many changes in men and things. Some of the older men had passed away, or were disabled by age and infirmities from active labor. Those who were young and little known had attained to maturity of years and an established reputation. A host of younger men had risen up. In those departments of science in which I am more especially interested, many new discoveries had been made, or new theories broached. The striking and prolific doctrine of the correlation of forces had been worked out. The method of spectrum analysis had been devised, enabling us to attain a knowledge of the chemical composition even of distant heavenly bodies. The hypothesis of the indefinite variation of species had been revived, and had rapidly become popular among the younger scientific men. The later tertiary deposits had yielded evidences of the possible existence of man in the time of the extinct mammoth; while the oldest rocks, before esteemed azoic, had yielded evidences of animal life. In physics, in chemistry, in geology, and in natural history, a multitude of new and important facts, filling great volumes of proceed-

ings and transactions, had been discovered and given to the world; so that every department of science might be said to occupy a new stand-point, and a host of new subjects of discussion had arisen. When we think of the vast range of study and investigation comprised in the proceedings of the British Association for the last ten years, and look back to the dim beginnings of science in a distant antiquity, and forward to the possible solutions of the hundreds of questions still agitated, it becomes a matter of doubt whether we should congratulate ourselves on the vast progress made toward the right understanding of nature, or should sink appalled in the presence of the apparent boundlessness of the unknown. True science is ever disposed to view its position with humility, and to regard the ever widening circle of knowledge as only ever enlarging our conceptions of the amount of what remains to be known, before we shall meet that point, where the possibilities of the finite understanding shall be overtasked, in the presence of an incomprehensible infinity.

The sessions of the British Association are limited to a week—a period generally found too short satisfactorily to dispose of the business. The proceedings open with a public address by the president for the year. The Association then divides into sections, each taking up a special subject, and organising itself with a president, vice-presidents, and committee. The sections at the Birmingham meeting were those of mathematical and physical science; chemical science; geology; zoology, botany and physiology; geography and ethnology; economic science and statistics; and lastly mechanical science. These sections are known respectively by the letters A to G. Each has its own room, and the meetings take place simultaneously, so that persons interested in different subjects are often sorely perplexed by the claims of rival papers; and it is not uncommon, after a popular paper, to see a section-room almost emptied, by the rush to be in time for some other topic of interest, in another section.

The committees of the sections meet every morning to arrange the business for the next day. The section meetings usually extend without intermission from 11 to 3 or 4 in the afternoon, and the evenings are occupied with social entertainments and lectures. It has of late years been the practice to organise excursions to local objects of interest on the Saturday, instead of the close of meetings as formerly, keeping the sections, or some of them, open at the same time. At the Birmingham meeting there were several interesting excursions of this kind; but there was much difference

of opinion as to the propriety of having such excursions on a regular day of meeting: some objecting to this, others saying that the sections should adjourn; the result being that those which did not adjourn were very thinly attended. Those who come for scientific purposes would prefer the sections; those who love pleasure, the excursions; and the local authorities do not wish to postpone the excursions to the end, knowing that, in this way, they lose most of the leading men.

The evening entertainments are not merely great crushes of well-dressed people; but they furnish an opportunity for meeting friends, and they are made the occasion of exhibiting many objects of interest in art, in manufactures, and in natural history. One of the evenings at Birmingham was occupied with an interesting lecture by Mr. Jukes, of the Geological Survey, on the probable extent and duration of the coal of South Staffordshire.

In organising the sections, any person, who is a member of a society publishing transactions, may be placed on the committees, and a few leading men are appointed vice-presidents. In some sections there is a glut of papers, and it is amusing to see the anxiety of some claimants for fame to get their papers in a good place on the list, while the committee is usually desirous to secure for good or popular papers the best places. On the whole, considering the hurried manner in which the work is done, there seems to be much fairness, though many who are disappointed complain of cliques and favoritism.

Prof. Phillips, the president of the year, and one of the founders of the Association, is a man of marked features, florid and light complexion, full eye, and large bald head, with thin whitened hair. His countenance is full of genial kindness and quick intelligence, and his step and manner are almost boyish in their elasticity and vivacity. His first scientific work was done on the Yorkshire coast, and he is now professor of geology at Oxford. He is remarkable for that width of information and accuracy of detail which characterise Dana among the American geologists; and, like him, he is a conscientious man, and a cautious generaliser; always to be found in the right place on moral questions, and never carried off his feet by the rush of novel speculations and hasty conclusions. In such questions as the much controverted glacial theories, he busies himself with accurate experiments and calculations of the crushing weight of columns of ice, and similar essential data; and he has a little astronomical observatory in which he applies, not his hammer, but his telescope to the planets, and has worked out

some interesting points in what may be called, for want of a better name, the physical geography of the planet Mars, showing approximately the distribution of its land and water, the movements of its clouds, the advance and recession of its polar snow-patches, and the constitution and temperature of its atmosphere. He is equally at home, and a diligent worker in fossils. Phillips is also a teaching geologist. I spent a most pleasant day with him and his able colleagues, Dr. Acland and Prof. Rolleston, at Oxford, in studying the admirable arrangements in the new museum and scientific library of that university—institutions which are now, thanks to these eminent men and their colleagues, second to none in England, in facilities for the study of physical and natural science. In all that relates to the arrangement of specimens for study, and affording due facilities to the student, Prof. Phillips is as careful and enthusiastic as in his original investigations; and I can imagine no man better suited to cultivate scientific enthusiasm among students, and to send out from the old university, educated naturalists for the next generation.

In the Geological Section, Sir Roderick Murchison, the president, and Sir Charles Lyell, the first on the list of vice-presidents, were the acknowledged heads; Sedgwick, the only other of the great geological leaders, was absent. Murchison is a man of imposing presence and gentlemanly exterior, bland and affable, ever striving to soften the asperities of discussion. Lyell, a man of less majestic aspect, but with a magnificent head, and thoughtful penetrating countenance, which, now that age is stealing upon him, impresses one all the more with the fact, that his is the greatest and most logical intellect, that has been brought to bear on the earth's history in our day. Murchison is the geologist of the palæozoic rocks, the most successful systematizer of the older formations, which, before his time, were involved in confusion. Lyell is the geologist of the cainozoic, or more recent period of the earth's geological history, the reducer to order of the heterogeneous and widely scattered tertiary deposits. Murchison, like Phillips, is a conservative geologist, slow to adopt new views, and striving to hold the balance between opposing theories. Lyell is the most progressive, and least conservative of the older geologists, and marches in the van of geological progress with as much alacrity as the youngest votaries of the science.

In glancing from these names to those that follow them in the lists of the Association, I feel that there is a wide interval. The

present state of natural science in England is that of a rapid transition from an era of giants to an era of mediocre men. This has often been the case in the history of science. One generation produces a crop of great men : the next, perhaps, a multitude of useful, but not brilliant or distinguished followers. It is quite apparent that such men as Lyell, Murchison, Sedgwick, Phillips, Owen, and Faraday have no worthy successors in their special departments of science in England. Not that able, hard-working, and successful men are wanting. There are many such; but it is evident that when the older men die off, their places will be occupied by far inferior minds; many of them mere collectors of facts, others framers of hypotheses which carry them away from truth; the best only fitted to carry forward creditably the work which men of greater genius have originated.

One of the most interesting subjects of geological enquiry at present is the question of the antiquity of man ; or, more properly, the question, with which of the later tertiary animals were the first men contemporary? In so far as Western Europe is concerned, there seems to be evidence that several great mammals have become extinct since man appeared on the stage, as, for example, the megaceros, or great Irish stag, the cave bear, and, perhaps, the mammoth and tichorhine rhinoceros. I believe, however, after a careful study of the accounts given of the several deposits in caves and elsewhere, in which these evidences are found, and after personal examination of the celebrated gravel-pits near Amiens, that any inference as to the absolute antiquity of man is altogether premature; and, indeed, the question as to which of the extinct quadrupeds of the later tertiary were contemporaneous with man, is far from being settled. One of the most interesting documents, relating to this subject, presented to the Association, was the report by Mr. Pengelly on the exploration of the cave near Torquay, called Kent's Hole, for which exploration a grant had been given by the Association. This cave presents on its floor four layers of different antiquity. 1. Blocks of stone fallen from the roof; 2. Black loam; 3. Stalagmite or calcareous matter, formed by the dripping of water, and mixed with stones; 4. Red clay or loam. In the upper layers are found modern objects—from the porter bottles thrown away by pleasure parties, to old bronze implements perhaps 2000 years old. In the stalagmite and clay are found a few stone implements, and the bones of animals, many of them now extinct. Much yet remains to be done in this cave, but it seems to have been proved that the flint

weapons must be as old as the time when the extinct cave bear lived in England. The mode of exploration pursued is very careful. The interior of the cave is divided into sections, and in each of these the loam is carefully removed, and the objects found in each layer and in each section of the layer are placed in separate labelled boxes, so that every specimen can be referred to the exact spot and depth from which it is obtained. In this way it is hoped that a series of indisputable facts relating to the animals which may have been contemporary with the primitive men of the stone age in England, may be obtained.

Another subject of discussion, belonging to the later tertiary period, is the agency of glaciers and icebergs in distributing the materials of the post-pliocene drift, and in excavating the basins of lakes. Prof. Ramsay, the great advocate of the theory of continental glaciers, was, unfortunately, absent; and most of the leading geologists present, being content with the received ideas of the joint action of icebergs and glaciers, there was little discussion, although several valuable papers were read, the most important being that of Prof. Phillips, on the physical conditions of the existence of glaciers.

Passing from the newest geological formation to the oldest, a very important communication, by Mr. Salter and Mr. Hincks, detailed the discovery of many curious fossils in rocks of the Cambrian period, below the oldest fossils hitherto known in England. They curiously illustrate the fact that, in the beginning of the animal life of the palæozoic period, all of the three lower provinces of the animal kingdom were represented; a striking contrast in this respect to the still older Laurentian, with its one fossil—the *Eozöon*—a representative of one, and that the most humble of the types of animal life. Mr. Salter also applied his discovery, in a very happy manner, to the illustration of the parallelism between the oldest silurian rocks of America and Europe; and more especially to the connection of the gold producing rocks, with the old slates holding *Paradoxides*, one of those curious connections between fossils and useful minerals which are constantly occurring, and which show the practical value of the study of fossil remains.

A paper by Prof. Harkness, on the limestones of Connemara, supposed to contain fossils similar to the *Eozöon* of the Canadian Laurentian, gave an opportunity of explaining to the section the steps by which the discovery of the fossil and its determination had been reached in this country. Prof. Harkness maintained, in regard to the Connemara rocks, that they are really Lower Silurian,

not Laurentian, and that they contain no true Foraminiferal remains, but the Canadian discovery was accepted on all hands as undoubted.

The writer happened to be the only representative of Canadian geology at the meeting, and, in that capacity, was honored by appointment as one of the vice-presidents of the section. He presented two communications, one on the succession of fossil plants in the older geological formations as evidenced in America; the other on the conditions of deposit of our boulder clay, and the evidence as to the climate of the period afforded by fossil plants. Both were well received, and led to some discussion; and he can testify, on this as on previous occasions, of the scientific men of Britain, that they are ever ready to receive a colonial brother on equal terms with themselves, and show none of that mean contempt for colonists which is too conspicuous in the political press of England. Scientific bodies, like the British Association and the learned societies of England, do not treat colonists as foreign members. They assign to them the same rights and duties as if they resided in the British Islands, evidencing in this way a truly imperial spirit in regard to the dependencies of the British Crown;—a spirit which would repudiate the Greek or Chinese policy of keeping colonies at a distance until they become strong enough to give trouble, and then casting them off, and would adopt instead the Roman principle of universal citizenship of the empire, extending over all its dependencies throughout the world.

This digression leads me to glance next at the Section of Geography and Ethnology, under the presidency of Sir Henry Rawlinson, the decipherer of the Nineveh inscriptions, and a courteous and amiable man. This is one of the most popular of the sections. Its stirring narratives of foreign travel in the central deserts of Asia, and in unexplored regions of Africa, attract all hearers; and the presence of the men actually engaged in these adventurous expeditions, increases the attraction. At the late meeting there were interesting communications as to the discovery, by Mr. Baker, of additional sources of the Nile, beside those made known by Speke, an exhibition of large paintings of the remarkable Victoria Falls on the Zambesi, and interesting discussions as to the proposed Palestine exploring expedition, and the expediency of another expedition with the view of reaching the North Pole.

A curious and somewhat disturbing element in this section is

the presence of the anthropologists, as they call themselves, a small but active body of scientific men, who have established a society in London with the view of studying the natural history of man. The object is, no doubt, good; but, unfortunately, it necessarily becomes mixed up with discussions about the unity of the human race, the probable descent of men from apes, and many other questionable subjects, which repel prudent and conscientious men, and are attractive to people who are eminent in nothing but in differing from other sensible persons. But the anthropologists are ambitious. They publish a journal, and they desiderate a separate section of the British Association. This was declined at the opening meeting of this year, but a compromise was entered into, and the greater part of the papers were handed over to the Geographical Section, coming under the head of ethnology. A very elaborate paper of this class was one by Mr. Crawford on the African Negroes, in which, while he adduced a vast variety of considerations tending to show their inferiority to other races of men, he nevertheless maintained that it was idle to imagine that they formed a link between men and monkeys. The writer seemed to have hit that exact mean which offends all parties. The more advanced anthropologists were indignant that he had not followed out his facts to the conclusion that the negro is only a better kind of ape. Others were disposed to repudiate as unfounded the alleged inferiority of the negro altogether. One of the points referred to in the paper, was the odor of the negro. To this a clever answer was given by a gentleman from the United States who happened to be present. He said that—"He could say, from actual knowledge and experience in the South, that the offensive smell of the negro was not regarded there. The whites were perfectly willing to associate with them on very intimate terms. No Virginian lady drove out without her negro maid in the carriage with her, and they slept in the same rooms with the young ladies, in the most aristocratic families. The only objection he had heard to the negroes as to their offensiveness, was when they were offensive enough to be free. The fact was, they were only offensive when they were overworked and unwashed, and persons of that class were, to a certain extent, to be found in every country."

Another objection to the negro was that he had not invented an alphabet; but it was urged in reply that the same might be affirmed of the English race—an argument not unlike that

adduced by a learned African at the Newcastle meeting of the Association, when he alleged, that the Romans had held that British captives were too stupid to be used as slaves, and since the negroes were already somewhat advanced above that level, good hopes might be entertained of them. In truth, the attempt to establish different species of men has been so completely overthrown by scientific reasoning, and is so abhorrent to right feeling and to revelation, that it is now scarcely tolerated by any intelligent audience in England.

In the Section of Zoology and Botany, presided over by Dr. Thomson, and the so-called Sub-section of Physiology, under the presidency of Dr. Acland, many interesting papers were read. One of the most popular, to judge by the notices of it in the newspapers, was a lengthy exposition of the methods and results of oyster culture, by Frank Buckland. The young oyster is locomotive when first detached from the parent, and in this state the 'spat,' as it is called, must attach itself to some fixed objects called 'cutch' before it can be developed into the perfect native, fit for educated human palates. Shells of dead oysters seem to be the favorite 'cutch,' but mussel shells and shells of other mollusks, and even pieces of earthenware and tiles, are not objected to. The importance of dead oyster shells, to afford holding ground to the new brood, was thus illustrated:

"There are but few localities where the shells of the dead oysters have accumulated in sufficient quantity to give the spat a chance of adhering. It is, therefore, necessary to collect these shells from elsewhere, and throw them down upon localities where the spat is likely to fall. This process is carried out by oyster culturists on a pretty large scale, and it seems almost providential that beds of oyster shells should be found in the neighborhood of the grounds which are cultivated. Thus, for instance, you will see on the map, a place called 'Pan Sand,' at the mouth of the Thames. Now, at this spot there is an accumulation of oyster shells; and dredging boats from various localities dredge up these shells, and carry them on to places nearer in shore and throw them again to the bottom of the sea, knowing full well that if there be spat floating about, and if they be in a proper condition to adhere, that this cutch will assuredly catch it. How this Pan Sand oyster bed came into existence I am quite unable to tell you; but from the appearance of the oysters themselves, I can assert that the oysters were of great age, that they had lived there many years

undisturbed by dredgers, and that a considerable time has elapsed since they thrived in this locality."

The oyster culture is now a very important branch of business, and I see that one sanguine theorist proposes to stock the whole estuary of the Thames with live oysters, to feed them on the sewage of London, and then, in turn, feed the whole population of London on the oysters.

The separation of physiology, or, as some prefer to call it, biology, from technical zoology and botany, is an indication of a somewhat important fact, namely, that those naturalists who have devoted themselves to questions of comparative anatomy, of chemical physiology, and researches as to the nature of vital force and the origin of species, regard questions of zoological and botanical classification and of geographical distribution with impatience, and are disposed more and more to separate themselves from the ordinary working naturalist. The effect of this, along with the almost inevitable tendency of specialists to underrate other branches of study than their own, will, without doubt, be in some respects damaging to the true progress of science; and, for some time, we must be prepared to find much good work spoiled by defective and one-sided classification, and crude hypotheses about the production of species by natural selection, and the supposed identity of vital forces with the forces of inorganic nature. The scientific pendulum swings just now in this direction; and it is not unusual to find men framing new classifications on the most petty anatomical grounds, without regard to broader affinities, reasoning about the convertibility of species in precisely the same strain in which alchemists, centuries ago, descanted about the transmutation of the metals, and imagining that because vital force supports itself at the expense of heat, or light, or electricity, that therefore it is identical with them: but the pendulum will swing back, and we shall find, perhaps, that the machine has, after all, kept up with the time; though it is sad to think that the path of knowledge is so tortuous, that so few can reach the goal, and that the oscillations of the pendulum represent so much vain expenditure of highly endowed mind.

It must, however, be admitted that much of the present difficulty in the way of sound biological science arises from the vast extent of the ramifications of the subject, and the impossibility of its being all grasped by one mind. In this way the very enlargement of our knowledge becomes a source of weakness, and the

great empires of the earlier zoologists become broken up with petty and powerless principalities. Only those great minds which appear at very rare intervals can rescue natural science from this kind of disintegration; and perhaps the time may come when no possible mind can do this. The question is not yet solved whether the power of generalization can keep pace with the collection of facts in nature. At present, of English-speaking naturalists we have only Agassiz and Owen who are at all able to grapple with the greater and wider questions of zoology, and both of these men are borne down with an intolerable amount of labor. Dr. Acland thus discoursed in his opening address on the difficulties of the subject:

"Although the wisdom of this Association entitles this meeting a sub-section, I am among the minority who cannot understand the force of the arguments which go to class biology (which term may be now used synonymously with physiology) as a subordinate subject. Being, when properly considered, the most complicated of all the subject matter debated at this Association, it cannot be really subordinate to any, least of all to zoology and botany, which it distinctly includes. It may be an open question whether physiology be a branch of physics and chemistry; it is not an open question whether it includes the knowledge of the characteristics upon which the classification of all entities that are said to have life is based.

"For the purposes of the great scientific question of this age, the causes of the present order of life on the globe, it would seem that the minutest accepted data of biological conclusion may have to be revised under new methods. It is a saying among painters, 'That a draughtsman sees no more than he knows.' It is true in the same way in natural science, that the real signification of a known fact may be concealed for ages. Of this, pathology offers many examples. The older naturalists, notwithstanding the great learning of such men as Linnæus and Haller, had comparatively either very simple or hypothetical and incorrect notions of the complexities of living beings and their constituent parts. Chemistry, the microscope, and the search for the origin of species, have, in this century, widened the horizon of biological study in a way not less surprising than does the dawn of day to a traveller, who, having by night ascended some lofty peak, sees gradually unfolding an extent and detail of prospect which he can generally survey, though he cannot hope to verify each detail and visit every nook in the brief time allotted to him to travel."

One of the ablest workers in these subjects at present, and one whose labors will live, after much that makes more sound now has become obsolete, is Dr. Beale, who read a good paper on "Life in its connection with cell structures and vital force."

In the somewhat inverted order in which I have noticed the sections, we come next to those of Mathematical and Physical Science, presided over by Mr. Spottiswoode; of Chemical Science, under the presidency of Prof. Miller, of King's College, London; and that of Mechanical Science, whose president was Sir William Armstrong of the guns. In the first of these sections a prominent place was occupied by the aeronautic exploits of Mr. Glaisher of the balloon committee, who, instead of slowly and laboriously collecting meteorological facts on the surface of the earth, visits the region of the clouds, and catches the rain and snow in mid-air, making us shiver with the information that at certain heights above the earth our summer showers are represented by drifts of snow. One of the most interesting facts in the present year's report, is the almost constant occurrence of south-west wind in the higher regions of the air over England—a fact satisfactorily explaining its warm and moist climate. Another most interesting subject, which occupied much of the time of this section, is the observations now being made by many astronomers on the superficial appearance and physical structure of the sun and other bodies of the solar system. Much attention has been given to those vast and remarkable disturbances in the luminous envelope or atmosphere of the sun, known as the solar spots, and it is probable that their laws of occurrence will soon be as well understood as those of the hurricanes and typhoons of our own atmosphere. The exploration of the surface of Mars, by Prof. Phillips and others, I have already referred to; and an elaborate map of the moon is in progress, in which every ridge and ravine of her scarred surface will be represented in such a way as to enable future observers to decide the question whether any physical changes are now in progress in our satellite. Most remarkable results have been obtained by the application of the method of spectrum analysis, and, among others, the interesting fact that the nebula of Orion, which had been resolved into apparent stars, is, after all, a gaseous mass with brighter spots or nuclei of gaseous matter, a fact tending to revive the evidence for the so-called nebular hypothesis of the formation of the solar system. Luminous meteors or shooting-stars were also the subject of a report, in which it was stated that the average height of these bodies is sixty miles above the earth, that the average number in

our atmosphere in a day rises to the astonishing amount of seven and a half millions, and that at any one instant there would be found in the space occupied by the earth and its atmosphere 13,000 of such bodies, all of which are supposed, like the greater planetary bodies, to be pursuing orbits of their own. Time would fail even to name the vast number of new facts of industrial importance brought before these sections—the Atlantic telegraph—the improvements in gun cotton—the applications of photography—researches in organic chemistry—new methods of coating iron with copper—machinery for extraction of coal—Bessemer's process for making steel—and the improvements in furnaces, are only a few of these subjects; and, with regard to one of these, it was stated by Sir W. Armstrong that it is not uncommon in ordinary furnaces to have two-thirds of the heat produced absolutely lost, while it would seem that in steam-engines no less than nine-tenths of the force generated is wasted.

In connection with this, and with a matter of interest to this country, where peat is already being worked, it was stated that a material named Torbite, suitable for the purposes to which coal is applied, may be made from peat, and sold at from 10s. to 12s. per ton, and that there are in Great Britain and Ireland no less than five millions of acres of peat, with an average depth of twenty feet.

The Section of Statistics was presided over by Lord Stanley, a man of unprepossessing appearance, with a somewhat nervous manner, but a close thinker and able speaker, markedly distinguished by a certain dogmatic utterance of plain common sense. In his opening address, he thus vindicated the claim of statistics to a place in the work of the Association:

"It has been questioned how far such subjects ought to form part of the business of a strictly scientific association; and I do not think the question unreasonable, for it must be admitted that, while our political economy itself, in its present state, is rather a collection of practical maxims, supported by reasoning, and tested by experience, than a science, in the same sense that astronomy or optics is entitled to that name, the topics to which the statistical method is applicable are infinitely various, and have little in common except this one characteristic—that in every case we appeal either to the numerical test of accuracy in figures, or else to fixed and recognised rules, which are assumed to have the same kind of certainty as prevails in physical science. How far that assump-

tion holds good in practice must depend on the judgment both of those who read papers, and of those who comment upon them. The truth is, in my opinion, that our functions here are rather those of suggesting and stimulating than of originating thought. Discussion, no doubt, we shall have, and in discussion new ideas are constantly generated, and new lights thrown upon previously unfamiliar topics; but it is not in crowded meetings, it is not in debating speeches, that any profound and original investigation can be carried on. Meetings like ours answer two purposes apart from that of social enjoyment; one is the diffusion — not the origination, but the diffusion—of ideas. Books and newspapers and reviews, no doubt, are the main agents for doing that work. Still it is, I think, indisputable that as seeing is proverbially more impressive than hearing, so what we hear orally delivered makes upon us a stronger impression than that which lies on a printed page on which our attention may or may not dwell. The other is the stimulus given to enquiry by the mere fact of investigations of this kind, or the result of them, being brought prominently or conspicuously before the public. Men go home with their heads full of subjects on which they perhaps never thought seriously before; and since, as I believe, nothing once known is ever really forgotten, since an idea which has once found lodgment in the mind, though its presence there may long have been barren, and though we ourselves may have been unconscious of it, will often spring up into life, after a long interval, it is difficult to determine what crop will not grow, sooner or later, out of the seed thus cast about apparently at random."

The following counsels to the readers of papers and speakers in the discussions, might be advantageously given to other bodies as well, and with them I shall close these notes;

"Let me only offer to those who take part in our discussions one or two suggestions. The first is, time runs fast. You can say all you have got to say in a few words, if you will think it over beforehand. It is want of preparation, want of exact thought, that makes diffuseness. Again: we don't want preambles or perorations. We are not a school of rhetoric; and in addressing an educated audience a good deal may be taken for granted. Lastly, we only wish to get at the truth of things. All ideas are welcome, but mere verbal criticism is of no value to us." J. W. D.