another sign of the same fact that the heads of this great technical college have asked me, a student of pure science, to distribute your prizes to-night. I should be misusing the opportunity you have given me if I did not assert the conviction, common both to you and me, that it is by means of the scientific study of various industries, study such as you here carry on, and such as will be carried on in the National Physical Laboratory, that trade and science alike will prosper.

The first nuggets in gold-bearing districts are often picked up upon the surface; but mines can only be worked on a large scale by organised industry. As we penetrate deeper into the secrets of nature, as the industrial struggle grows keener, the rough and ready methods of the past will not win either knowledge or wealth.

We cannot afford to dispense with the old virtues. If we become slack and idle, if we devote to sports, innocent and useful in their place, the energy and attention which others are giving, not to the amusements, but to the business of life, we shall be, as we shall deserve to be, beaten. But to the old virtues we must add new methods, and among these none seems to me more praiseworthy than that a great municipality should determine that the lads who embark on the principle industries of the town shall have an opportunity of mastering the scientific principles on which those industries are based, and shall be shown, as they master them, how the principles are to be applied to the business of life.

THE ALLIANCE BETWEEN SCIENCE AND INDUSTRY.

LAST September Prof. Carhardt communicated to the American Institute of Electrical Engineers a very complete account, which has recently been printed in *Science*, of the Reichsanstalt at Berlin. He had worked there as a guest for some months in 1899, and had thus gained an insight into its management and organisation. The details he gives of these are very interesting, and the proof of the value of the work done, and of its consequences to German industry, most striking. The cost of the Institution, we may note, was about 200,000*l.*; the annual expenditure amounts to about 15,000*l.* After mentioning these figures he continues, "A very pertinent inquiry is, what are the results of all this expenditure?" and a careful analysis leads him to the conclusion that, "The results have already justified, in a remarkable manner, all the expenditure of labour and money. The renown in exact scientific measurements formerly possessed by France and England has now largely been transferred to Germany. Formerly scientific workers in the United States looked to England for exact standards, especially in the department of electricity, now they go to Germany." And again, "Germany is rapidly moving toward industrial supremacy in Europe. One of the most potent factors in this notable advance is the perfected alliance between science and commerce existing in Germany. Science has come to be regarded there as a commercial factor. If England is losing her supremacy in manufactures and in commerce, as many claim, it is because of English conservatism and the failure to utilise to the fullest extent the lessons taught by science."

ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held as usual on St. Andrew's Day, November 30, in the apartments of the Society at Burlington House. The auditors of the treasurer's accounts having read their report, and the secretary having read the list of Fellows elected and deceased since the last anniversary, the president (Lord Lister) proceeded to deliver the anniversary address. After referring to the losses by death sustained by the Society since the previous anniversary, and briefly noticing the work and careers of the deceased Fellows, the president continued his address as follows:—

Through the Malaria Committee the Society has kept in touch with the progress that has been made in unravelling the mystery of the greatest scourge of our tropical colonies, and with the steps that advancing knowledge has suggested for its suppression. The subject has now reached a stage at which it may be not unfitting to refer briefly to what has been accomplished.

The term "malaria" implied the belief that some vitiated state of the atmosphere was the cause of the disease. But the knowledge gained of late years of the parasitic nature of infective disorders pointed clearly to such an origin of the intermittent fevers, as the various manifestations of malaria have been termed. Accordingly diligent and long-continued search was made in the water and the soil of malarious districts in Italy for the suspected living agent, but without success. The discovery was made in 1880 by Laveran, a French army surgeon stationed in Algiers, who observed in the red blood corpuscles of malarious patients what he regarded as adventitious living organisms; not of vegetable nature like the bacteria which constitute the *materies morbi* of so many infective diseases, but a very low form of animal life. In what he believed to be the youngest condition of the organisms, they appeared in the red blood-discs as tiny specks of colourless protoplasm, possessing amœboid movements. These, growing at the expense of the red corpuscles which they inhabited, consumed them more or less completely, at the same time depositing in their own substance a peculiar form of dark brown or black pigment, such as had long been known to form characteristic deposits in the organs of malarious subjects. As they grew they assumed various forms, among which was what Laveran termed the "rosace," a rounded body bearing at its circumference little spherules, while the pigment was accumulated at the centre (*vide* Laveran, Du Paludism, Paris, 1891).

This discovery of Laveran's, at first regarded with the gravest suspicion by pathologists, was the first great step in the etiology of malaria. It supplied the means of distinguishing the disease from its counterfeits, and it explained the wonderful specific efficacy of quinine, till then given only empirically. Quinine is remarkable in the circumstance that it acts with deadly effect upon some microbes, in dilutions which are quite unirritating to the human tissues. It can thus be given in sufficient doses to kill the malaria parasite in the blood without injuring the patient.

Nine years after Laveran's discovery, Golgi, of Pavia, who had been specially studying the "rosace" form of the parasite, and who had become convinced that the spherules at the circumference of the rosace were sporules of the microbe, announced that he had observed differences between the rosaces of the tertian and quartan forms of the fever so great and so constant as to make him satisfied that they were two distinct species of organism. At the same time he had made the extremely important observation that the periods of occurrence of the fever corresponded with the times of maturation of the rosaces. These, all coming to maturity about the same time, shed their sporules into the blood, and this determined the febrile attack. The free sporules then, according to his view, attached themselves severally to other red discs, constituting Laveran's tiny amœbæ, and grew in the red copuscles without causing symptoms till they had produced a fresh crop of sporules ripe for extrusion, the time for this being two days in the tertian and three days in the quartan form. Thus the periodicity of the intermittent fevers and their variety in that respect were alike explained. (*Vide* Laveran, *op. cit.*)

A few months later a third species of the parasite was recognised, having the peculiarity that some of its individuals, instead of being of rounded form, were of crescentic shape. This species received the title æstivo-autumnal, on account of the season in which it showed itself in Italy. It was not so regular in its periods as the others, and was much more dangerous. The existence of these different species was at first very generally doubted, but it is now universally accepted and is of very great importance. The examination of a drop of blood from the finger of the patient enables the physician to decide, not only whether the disease is malaria, but which of the three types it will follow. The more dangerous crescent form is commonest in the tropics, and hence has been termed by Koch

tropical malaria. The quartan has proved the mildest of the three.

The process of sporulation might seem at first sight to explain the whole life-history of the parasites. For their propagation within the human body that process does indeed make ample provision. But the mystery remained—how did they gain entrance into the human system? Though present in abundance in the blood of the malarial patient, they are absent from the excreta. Spontaneous generation having been long since exploded, what could be their mode of origin in the external world? This problem has of late been completely solved.

Among the forms of the parasite observed by Laveran was one which he termed "flagellated," possessing filamentous appendages which exhibited extremely active movements, by virtue of which they were often seen to break off from the parent microbe and swim away. These flagella were regarded by many biologists as products of degeneration resulting from the abnormal influences to which the parasites were exposed in blood outside the body. This Laveran could not believe: indeed, it was the remarkable activity of the flagella that finally satisfied his own mind that what he had discovered were really living parasites: he regarded the flagella as the highest form of development of the microbe. There was another observer who felt equally convinced that the flagella were living elements—our Fellow, Dr. Manson. He, however, went a step further. Seeing that the flagella were never met with in blood when first drawn, but only made their appearance after some little time had elapsed, he conceived that their function must be that of spores for spreading the parasite in the external world, and some suctorial insect seemed to him the probable agency for their diffusion. He had observed several years ago that another parasite of the human blood, a microscopic nematode worm, Filaria, is drawn with the blood into the stomach of a kind of mosquito, and finds in the insect a secondary host, in the tissues of which it passes through a new cycle of development. He became deeply impressed with the idea that a similar series of events might occur with malaria, and he expounded his views fully before the College of Physicians. The notion that mosquitoes might be in some way associated with malaria had occurred to Laveran and to others, but by no one had it been brought home with such logical force as by Manson.

Major Ronald Ross, of the Indian Medical Service, on a visit to this country, became deeply impressed by Manson's arguments, and determined to test his theory on returning to India. Using mosquitoes bred in bottles from the larva, he caused them to bite persons affected with the crescent form of malaria, and afterwards sought in the bodies of the insects for evidence of the development of the parasite within them. For two long years he pursued this search, making about a thousand observations, but to no purpose. So far he had employed two kinds of mosquito common in the district where he was stationed; but in August 1897, having been supplied with some larvæ of a species rare in that locality, and having bred the fully developed insects from them, he induced eight of them to bite a patient with crescents in his blood, and examined their tissues at successive periods. Four of them were killed at once for the investigation of the flagellated bodies. Of the remainder, one examined four days after biting showed, under a high magnifying power, several rounded bodies imbedded in the wall of the stomach, differing from any natural structure of the insect, and containing granules of pigment "identical in appearance to that of the parasite of malaria" (*vide British Medical Journal*, December 18, 1897). The eighth mosquito was killed one day later, and exhibited bodies precisely similar except that they were distinctly larger and more substantial, implying that they had grown in the interval. Thinking that in all probability he had at length found that which he had been so long in search of, and feeling uncertain when he might again obtain the rare species for confirmatory investigation, he at once sent a description of his observations to London, accompanied by his preparations and an independent report upon them by a colleague. Dr. Manson, to whom, among others, they were submitted, was so much struck with the preparations that he had a drawing made of the pigmented bodies in them for publication along with Ross's paper. Though, like Ross, expressing himself with caution, he inclined to his interpretation of the appearances. The paper contained a minute description of the rare mosquito, which seemed to Ross to belong to a "family distinct from the ordinary" kinds.

In the following month he made a similar experiment with another species of mosquito which appeared closely allied to the subject of his last observations. He succeeded, though with some difficulty, in getting two of them to bite a patient with crescents. One of these insects, killed next day, was examined with a negative result; but in the second, killed forty-eight hours after biting, the peculiar pigmented bodies were again seen among the tissues of the stomach. Meanwhile, "some scores" of the species, "unfed or fed on healthy blood, had been examined without finding the cells."

In the same month he observed precisely similar pigmented bodies in a common mosquito which he had seen feeding on a patient affected with the parasite of mild tertian fever. Here he had not the rigorous evidence supplied by insects bred from the larva;[1] and it was quite a new thing to find the pigmented bodies in ordinary mosquitoes. But all the patients on whom his previous observations on the common species had been made had been affected with crescents; and the parasite concerned being in this case a new species, it did not seem unlikely that it might be harboured by the common insects.[2] These new facts removed all doubt from his mind; and he felt that he had the subject in his grasp, and wrote to that effect to Manson. But, to his bitter disappointment, he was at this time despatched to another part of India to study another disease; and thus several precious months were lost.

In February 1898, however, he was told off for the special investigation of malaria, and a laboratory in Calcutta was set apart for his use.[3] Few cases of human malaria being available at that season of the year, he turned his attention to some closely allied forms of disease common in birds. He soon found that one of the ordinary kinds of mosquito, which had invariably given negative results when fed on patients with crescents, developed pigmented bodies among the tissues of the stomach if fed on birds, such as sparrows, containing in their blood the form of bird parasite known as Proteosoma. The birds presented a ready field for experiment; and the kind of mosquito, the grey mosquito as he termed it, was very abundant in Calcutta, so that it was easy for him to hatch from the larva any number that he might require. Discoveries now followed each other in quick succession. He soon announced that the pigmented bodies grew rapidly from day to day, till after about a week they assumed large proportions, projecting like buttons from the outer surface of the stomach, and often showing a curious appearance of radiating striæ. Next we learned that the striæ had been indications of spore formation, and that when the bodies had attained maturity they burst into the general body-cavity, discharging enormous numbers of minute elongated organisms which he termed "germinal rods." Then followed the remarkable observation that the germinal rods soon leave the general body-cavity, and accumulate in the cells of the salivary or poison glands and in the duct leading from them to the proboscis, with which the bites of the insect are inflicted. And, lastly, he completed the cycle of evidence by ascertaining that healthy sparrows could be infected with the Proteosoma by causing mosquitoes to bite them at the appropriate period after biting an infected bird.

Thus was, in truth, established the mosquito theory of malaria. For taking into account the close resemblance of the Proteosoma to the parasites of human malaria, together with the facts ascertained by Ross regarding the infection of the rare mosquitoes with human crescents, we could not doubt that the course of events which he had traced in the sparrow occurred also in man. And the two sets of observations, taken together, clearly established the fact that, as Manson had predicted, different species of malarial parasite may require different kinds of mosquito as their alternative hosts.

At the same time, the presence or absence of the pigmented bodies in the stomach wall afforded a sure means of distinguishing those kinds of mosquitoes which convey malaria to man from those which are incapable of doing so. And it may be added that the multitude of negative results after feeding grey mosquitoes with crescent blood, considering the great prevalence

[1] *Vide British Medical Journal* (February 26, 1898). In this second paper Ross did not repeat the description of his method, given in the former article, of using mosquitoes bred in bottles from the larva. But as that had been his practice for more than two years, there can be no reasonable doubt that he continued it with this new species. I have also his personal assurance that such was the case.

[2] As the result of further knowledge, there is no doubt that this common mosquito had derived its pigmented bodies, not from the man it was seen biting, but from a bird affected with another species of malarial parasite.

[3] It has seemed necessary to refer to these points in detail, as considerable misapprehension has prevailed in some quarters regarding them.

in Indian birds of the parasite with which that species of insect is liable to be infected, afforded pretty conclusive evidence that the mosquito never derives the germs of malaria from the larva and can acquire them only by biting some infected animal.

But although the mosquito theory was thus demonstrated, there remained a link wanting in the chain of biological sequence. The flagella which Manson regarded as spores were destitute of malarial pigment, whereas the smallest corpuscles seen by Ross in the stomach wall invariably possessed it. How was this inconsistency to be explained? What was the relation of the unpigmented flagellum to the pigmented corpuscle? The answer had been already independently supplied.

I was present at a sitting of the Zoological Section of the British Association at the Toronto Meeting in 1897, when Dr. MacCallum, a young pathologist of the Johns Hopkins University at Baltimore, read a paper describing the results of an investigation in which he had long been engaged into another form of malaria parasite, Halteridium, especially common in crows. He told us, and he illustrated his statements with preparations under the microscope, that he had distinguished differences, which he regarded as fundamental, between the spherical bodies seen in the shed blood of a bird affected with that parasite. Though alike in size, some had a more granular protoplasm than the others, which had a more hyaline aspect; and he had observed that the more hyaline ones alone emitted flagella. These, after wriggling themselves free from the parent cell, swam away till they approached some corpuscle of the other, more granular, sort; when the first that reached it plunged into its substance and disappeared, while all others were, by some amazing provision, absolutely refused entrance. Here, then, was witnessed, in an exceedingly low form of animal life, a process of fertilisation identical with that which occurs in an echinus or a fucus. The flagella were neither more nor less than spermatozoa, and the more granular cells were ova. As the result of the fertilisation, the female cell was seen by MacCallum to alter its shape in the shed blood and assume an elongated form to which the term vermiculus was applied. This new creature was possessed of wonderful powers of locomotion, sometimes in its powerful career piercing through the substance of a red corpuscle.[1] Nothing could well be imagined better adapted for penetrating the layer of cells that line the stomach of the mosquito; and as the vermiculus retained its pigment, Ross's pigmented bodies were naturally accounted for.

These observations of MacCallum's might seem at first almost too wonderful for credence; but they have been fully confirmed by others.

It appears to be doubtful whether Halteridium ever produces the "rosace" form, with its attendant sporulation; but there is no doubt that the process of fertilisation seen in that parasite occurs in human malaria. MacCallum himself observed the act of conjugation in the crescentic human form; though he did not see the subsequent development of the vermiculus. Koch made a further step by observing the vermiculus of Proteosoma in blood from the mosquito's stomach.[2] And, finally, our medallist Grassi, who in other ways has made most important contributions to this subject, has, in a recent work (*vide* Grassi, "Studi di uno Zoologo sulla Malaria," Roma, 1900), accompanied by very beautiful illustrations, not only described the presence of vermiculi in abundance in the blood in the stomach of mosquitoes during the first two days after biting patients affected with malaria, but he has traced and figured the pigmented bodies of the smallest size in the tissues of the stomach in the immediately succeeding period, these bodies retaining in some instances the elongated form of the vermiculus after passing through the layer of epithelium that lines the cavity of the organ.

It has thus been abundantly established that the parasites of malaria are present in the patient's blood in two distinct forms, one sporulating asexually in the human system and causing the attacks of fever, the other undergoing sexual development in the body of the mosquito. That both forms are developed from the spores introduced by the mosquito is certain. At what stage they begin to develop their respective peculiarities is not yet quite made out. The crescent form is peculiarly favourable for this inquiry, as it is the crescents only which discharge the sexual function; and they are easily distinguished from the sporulating kind, not only by their shape, but also by their much larger size.

The development of the crescents has been specially studied by the Italian pathologists, Bastianelli and Bignami,[1] who have been able to distinguish the young crescents while still of extremely small dimensions; and they have made the remarkable observation that, while the crescents are as a rule only found in the blood of the finger when they have arrived at maturity, the young forms are to be seen in internal organs, such as the spleen, but above all in the bone marrow, where alone, according to these observers, the youngest recognisable crescents are to be found.

Seeing that, in whatever part of the body they are, the parasites always inhabit the blood, it seems difficult to conceive what can be the cause of their preference, at different stages of their growth, for the blood vessels of different regions and organs. But of this we find parallels in several other cases of blood parasites, the most striking, perhaps, being the astonishing fact that, of two species of Filaria that infest the human blood, one only shows itself in superficial parts at night, and is therefore termed *Filaria nocturna*, while the other has the name *Filaria diurna*, because it only appears by day in the finger blood and retreats into deep parts for the night.

Ross was not an entomologist, and he was unable to learn in India the names of the species of mosquito with which he had been working, till Daniels, one of the explorers sent out by the Malaria Committee, having gone to Calcutta to confirm or otherwise Ross's work, informed him that his rare kinds, which acted as hosts for the human crescents, belonged to the genus Anopheles, and that the common sort which performed the same office for Proteosoma, belonged to another genus, Culex. It has been a matter of great interest to ascertain whether all mosquitoes which act as conveyers of malaria to man are of the genus Anopheles, and the exceedingly common and numerous species of Culex are guiltless in that respect. Very numerous investigations into this question, and especially those conducted by Grassi and his coadjutors, seem to have proved that such is the case, and that, so far as human malaria is concerned, Anopheles alone have to be considered.

Our other two explorers, Messrs. Christophers and Stephens, have made various important contributions to our knowledge of malaria. Thus, having paid special attention to the very dangerous disease which, on account of one of its symptoms, is termed blackwater fever, they have come distinctly to the conclusion that it is not a special disorder but a form of tropical malaria. If this is the case, it is of immense practical importance; for it will follow that any means efficacious for ordinary malaria will prove equally so for the deadly blackwater fever.

Another most important fact which they have ascertained, and which was independently observed by Koch, is that in a native population in a malarious region, while the adults may be perfectly free from the disease, the young children contain the parasites in their blood in an enormously large percentage. Though the disease appears to be much less dangerous to the native children than to new arrivals, implying that they have a degree of congenital immunity, the parasites in the young natives are perfectly efficacious for causing dangerous fever in white people when conveyed to them by mosquitoes. Hence the important practical inference that white people settling in a malarious tropical region should not, as they now commonly do, plant their houses near native settlements, but place them at some considerable distance from them, about a quarter of a mile being apparently sufficient. And Christophers and Stephens in their last communication have gone so far as to express the opinion that the following of this simple rule would go very far indeed towards rendering the malarious tropics healthy to Europeans.

In a communication to this Society, it is the scientific side rather than the practical that is naturally chiefly dwelt on. Yet I should have been glad, had time permitted, to have referred to the various measures of prevention and treatment of malaria which the light of recent knowledge has already suggested, and which have already borne important fruit. I must now content myself with saying that, very various as these measures are, they are all, without exception, based on the mosquito theory.

[1] *Vide* On the Hæmatozoan Infection of Birds, by W. G. MacCallum, M.D., *Journal of Experimental Medicine*, vol. iii. No. 1, 1898.

[2] *Vide* Ueber die Entwickelung der Malaria Parasiten, R. Koch, *Zeitschrift für Hygiene und Infectious Krankheiten*, Band xxxii., 1899. Exceedingly beautiful microphotographs of different kinds of malaria parasites in various stages of development accompany this article.

[1] *Vide* "Sulla Struttura dei Parassiti Malarici," per G. Bastiani ed A. Bignami. Società per gli Studi della Malaria, 1899.

The medals were then presented as follows :—The Copley Medal to Prof. Marcellin Berthelot, For.Mem.R.S., for his brilliant services to chemical science ; the Rumford Medal to Prof. Antoine Henri Becquerel, for his discoveries in radiation proceeding from Uranium ; a Royal Medal to Major Percy Alexander MacMahon, F.R.S., for the number and range of his contributions to mathematical science ; a Royal Medal to Prof. Alfred Newton, F.R.S., for his eminent contributions to the science of ornithology and the geographical distribution of animals ; the Davy Medal to Prof. Guglielmo Koerner, for his brilliant investigations on the position theory of the aromatic compounds ; and the Darwin Medal to Prof. Ernst Haeckel, for his long-continued and highly important work in zoology, all of which has been inspired by the spirit of Darwinism.

The Society next proceeded to elect the officers and council for the ensuing year. The following is a list of those elected :—

President : Sir William Huggins, K.C.B. ; Treasurer : Mr. A. B. Kempe ; Secretaries : Sir Michael Foster, K.C.B., Prof. Arthur William Rücker ; Foreign Secretary : Dr T. E. Thorpe ; other Members of the Council : Prof. H. E. Armstrong, Mr. C. V. Boys, Dr. Horace T. Brown, Mr. W. H. M. Christie, C.B., Prof. E. B. Elliott, Dr. Hans F. Gadow, Prof. W. M. Hicks, Lord Lister, Prof. W. McIntosh, Dr. Ludwig Mond, Prof. A. W. Reinold, Prof. J. Emerson Reynolds, Dr. R. H. Scott, Prof. C. S. Sherrington, Mr. J. J. H. Teall, Sir J. Wolfe Barry, K.C.B.

In the evening the Fellows and their friends dined together at the Whitehall Rooms.

NOTES.

DR. E. VON MOJSISOVICS, Vice-director of the Austrian Geological Survey, has obtained permission to retire from the active staff of the service on account of the state of his health. But his scientific labours will suffer no interruption. In particular he will be able to continue, and, it may be expected, bring to an early completion, two important works on which he is engaged —"The Cephalopoda of the Halstatt Limestone," and "The Geology of the Salzkammergut."

PROF. J. PERRY, F.R.S., presided at the annual dinner of the Institution of Electrical Engineers on Monday, and in responding to the toast of the Institution he compared the profession of electrical engineering with a baby, inasmuch as the members were ignorant of its future, though they knew that its life would be affected by the action adopted now. Other speakers were Lord Alverstone, Lord Kelvin, Sir J. Wolfe Barry, Sir G. Kitson, and Sir Courtenay Boyle, who spoke as the representative of a department (the Board of Trade) which has to do with the translation of scientific researches into commercial facts.

MR. I. H. BURKILL, of the Royal Botanic Gardens, Kew, has been appointed assistant to Dr. Watt, and will shortly leave for Calcutta.

WE learn from the *Athenaeum* that an official announcement has been made to the effect that the Viennese Akademie der Wissenschaften intends sending an expedition to Brazil in 1901, which will have for its object the study of the flora of that country. It is to a certain extent a sequel of the expeditions of the early part of this century, which resulted in the publication of that monumental work the "Flora Brasiliens." The botanists accompanying the party are Prof. Dr. Richard von Wettstein, Director of the botanical garden of the University, and Dr. Victor Schiffner of Prague.

IT is announced by the Colonial Office that the Pacific Cable Committee have accepted, on behalf of her Majesty's Government and of the Governments of New South Wales, Victoria, Queensland and New Zealand, the tender of the Telegraph Construction and Maintenance Company for the manufacture and laying of the projected Pacific cable. The amount of the tender is 1,795,000*l.*, and the work is to be completed by the end of 1902. The cable will run from Vancouver to Queensland and New Zealand, *via* Fanning Island, Fiji and Norfolk Island.

A FEW particulars concerning the Antarctic expedition in course of organisation in Sweden, by Dr. Otto Nordenskjöld, are given in the *Times*. For the purpose of his Antarctic expedition Dr. Nordenskjöld has acquired the steam-whaler the *Antarctic*, which was built for whaling in the Greenland seas by a Norwegian firm, and has performed many voyages in Polar waters. She was eventually acquired by Prof. G. Nathorst, the celebrated geologist and Arctic traveller, who has shared in almost every Swedish Polar expedition. Last year, again, the *Antarctic* was employed in the search for Andrée on the east coast of Greenland, when the owner himself was in command of the expedition, but which yielded no result. The vessel will proceed to Gothenburg for her final equipment. Dr. Nordenskjöld estimates the cost of the expedition at only some 10,000*l.* Of this sum one-half has already been contributed by Swedish subscribers, and King Oscar, with his well-known interest in Swedish explorations, has also promised a considerable amount towards this expedition, the first of its kind ever dispatched from Sweden. Should circumstances permit, the Swedish expedition will, of course, co-operate with the British and German. It is hoped that the *Antarctic* will be ready to sail next August.

THE Lincolnshire Naturalists' Union has recently received several valuable additions to its museum. Further space is required for a large collection of fossils and specimens of rock formation recently presented by Mr. Melville. A large case of drawers containing a number of birds' skins from the collection of the late president of the Union (Mr. John Cordeaux) has been presented by Mrs. Cordeaux. A large collection of fossils and specimens of rock formation has been presented by Mr. A. S. Leslie-Melville. The collections would make a good nucleus for a county museum, and the City Council of Lincoln is to be asked to make suitable provision for them.

IT is satisfactory to know that British engineers and manufacturers are seriously examining the causes which have enabled German and American works to successfully compete with their productions. Sir Lowthian Bell dealt with the subject in his address to the Institution of Junior Engineers on November 30. In the course of his remarks he said : "Some correspondents of our newspapers attributed our loss of ground in the race to ignorance of the scientific truths on which success was dependent ; but they could not be aware that at Newcastle, Leeds, Nottingham, Sheffield, Edinburgh and Glasgow there were large and well-appointed colleges for teaching the sciences which for the last twenty-five years had been deemed indispensable in Great Britain for a successful career in metallurgy. Moreover, every ironworks of any importance possessed a suitable laboratory as a guide in its daily operations as well as for original research. Comparison between the United States and England involved two conditions—that imposed by nature, and that resulting from ignorance and consequent want of skill ; the former was unavoidable, the other susceptible of remedy. Now, taking the Middlesbrough district in this country and Pittsburg and its vicinity in America, it appeared that the final cost of the minerals, mining and carriage included, consumed for each ton of pig iron at Pittsburg and Middlesbrough was almost identical." Though Sir Lowthian Bell's estimate of the alleged advantages of the Pittsburg works may do something to reassure British manufacturers, his remarks as to educational facilities and industrial research are not so convincing. True, we have our University Colleges and Technical Schools, but in how many districts are they considered by the manufacturers to have