just behind the skull, which served to protect this part of the neck."

"All these plates and spines, massive and powerful as they now are, were in life protected by a thick horny covering, which must have greatly increased their size and weight. This covering is clearly indicated by the vascular grooves and impressions

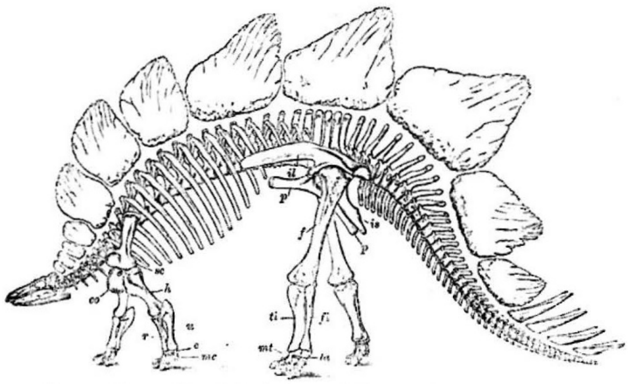

FIG. 3.—Restoration of the skeleton of *Hypsirophus ungulatus*, $\frac{1}{60}$ natural size. *sc.*, scapula; *co.*, coracoid; *h.*, humerus; *r.*, radius; *u.*, ulna; *c.*, carpus; *mc.*, metacarpus; *il.*, ilium; *p.*, pubis; *is.*, ischium; *fe.*, femur; *t.*, tibia; *fi.*, fibula; *ta.*, tarsus; *mt.*, metatarsus. (After Marsh.)

which mark the surface of both plates and spines, except their bases, which were evidently implanted in the thick skin."

To this graphic description of one of the most extraordinary creatures that lived in a world of monsters, it may be added that the remarkably tall neural arches of the dorsal vertebræ and the concomitant elevation of the proximal ends of the ribs nearly to the level of the summits of their neural spines appear to be for the purpose of aiding in the support of the enormous weight of the armour of the back.

Since we have already given more than one notice in NATURE of various portions of the horned armoured Dinosaurs of the Cretaceous of the United States, as represented by *Agathaumas* (= *Ceratops* and *Triceratops*), our notice of Prof. Marsh's recent restoration of this creature (Fig. 4) will be but brief. That these reptiles were nearly related to the Armoured Dinosaurs is undoubted; they attained, however, greater specialisation in the skull, which was of enormous size and armed with bony horn-cores, arranged as a pair above the eyes and a single one over the nose. The enormous size of the head and the proportionately large fore limbs indicate that these animals were always in the habit of walking on all fours; and, as we have previously suggested, the loss of the posterior shaft of the pubis, so well shown in the figure, is probably due to a reversion to these quadrupedal habits.

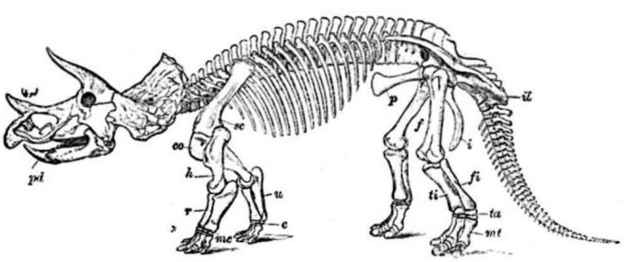

FIG. 4.—Restoration of the skeleton of *Agathaumas prorsus*, $\frac{1}{80}$ natural size. Letters as in Fig. 2. (After Marsh.)

In regard to this restoration Prof. Marsh remarks that "the skull is, of course, without its strong horny covering on the beak, hon-cores and posterior crest, and hence appears much smaller than in life. The neck seems short, but the first six cervical vertebræ are entirely concealed by the crest of the skull, which in its complete armature would extend over one or two vertebræ more. . . . . No attempt is made in this restoration to represent the dermal armour of the body, although in life the latter was more or less protected. Various spines, bosses, and plates, indicating such dermal armour, have been found with remains of this group, but the exact position of these specimens can at present be only a matter of conjecture. . . . . The size in life would be about twenty-five feet in length and ten feet in height."

The extraordinary contrast between the skeletons of *Agathaumas* and *Brontosaurus* will be sufficiently apparent from a comparison of the respective figures.

The typical section of the bird-footed Dinosaurs, as represented by the Iguanodons (Fig. 5) is now so well known that but few remarks are necessary. They differ from the armoured forms in their perfect adaptation to a bi-pedal mode of progression, their digitigrade feet, hollow limb-bones, and absence of armour; the Iguanodons being further distinguished by the curious modification of the thumb into a stout conical spine. Those who have visited of late years the Brussels Museum will not fail to retain a vivid impression of the imposing show made by two mounted skeletons of these enormous reptiles displayed in a case in the court-yard of the museum. According, however to a striking picture which appeered a couple of years ago in the *Graphic*, these two skeletons have now been removed to within a special gallery in the Museum, where, together with three others, they must excite the admiration and wonder of all who have the good fortune to behold them. With such a lavish display of their own, it is, perhaps, scarcely too much to hope that the authorities of the Royal Brussels Museum may before long see their way to enriching our own National Collection

FIG. 5.—Restored skeleton of *Iguanodon bernissartensis*. About $\frac{1}{40}$ natural size. (After Dollo.)

either with an original specimen, or at least with a plaster reproduction of one of the already mounted Iguanodon skeletons.

Although there is no lack of work remaining to be done among the Dinosaurs, yet when we reflect that practically our whole definite knowledge of the group dates from within the last twenty years, and that all the five restorations at which we have glanced have been made within the last ten, we cannot but fail to be gratified at the enormous progress that has been made by this branch of palæontology within that comparatively short period. If this progress cannot be justly entitled to be termed one advancing by "leaps and bounds," yet we think that it may, on the whole, be truly described as "slow and sure."

R. LYDEKKER.

THE INTERNATIONAL MARITIME CONGRESS.

DURING nearly the whole of last week a most important congress was being held in London at the Institution of Civil Engineers. This was the International Maritime Congress, an institution founded in Paris in 1889, when no less than twenty-two papers on various maritime subjects were read and discussed, and visits were made to some of the most important seaports on the north and west coasts of France. The international commission, which constitutes the executive, determined that the second meeting of the congress should be held this year in London, and as a result the first sitting took place on July 18, when the opening proceedings were got through in the morning by the delivery of various complimentary addresses, whilst in the afternoon the more serious business of the congress commenced.

The proceedings were divided into four sections, as follows :—

Section I. Harbours, Breakwaters, &c.
,, II. Docks and their Equipment.
,, III. Shipbuilding and Marine Engineering.
,, IV. Lighthouses, Fog-signals, &c.

There were in all over forty papers set down for reading and discussion, and all but a few were so disposed of, only one or two being taken as read. Such a feat speaks highly of the industry of the various sections, and it will be understood that in this general notice we can do little more than give a list of the various papers read. Lord Brassey was president of the congress, and Mr. James Forrest, honorary secretary. Mr. C. F. Findlay was secretary. The headquarters were 25, Great George-street, Westminster.

Section I. met in the theatre of the Institution of Civil Engineers at 2 p.m., on Tuesday, July 18. It should be stated that arrangements had been made for different chairmen to officiate at the various meetings. Mr. L. F. Vernon-Harcourt was the moving spirit in this section, and naturally presided at the meetings although he did not occupy the chair.

The first business was the reading of two papers, one on "The Breakwaters and Harbours of Middlegrunden," by Capt. P. Hansen ; and a second on "The Harbour and Breakwater of Copenhagen," by H. C. V. Möller. These papers were taken together, but the meeting voted that the discussion should be deferred to the next day. A paper on "Recent Breakwaters and Sea Defences in Italy," by Chev. L. Luiggi, was next read ; and a fourth paper on "The Construction of Breakwaters," by Baron Quinette de Rochemont, brought the proceedings of the first day in this section to a close. All these papers were of a special and strictly professional character. It is to be regretted that the order in which they were originally set down was not followed, and Baron de Rochemont's contribution was not taken first. The whole of them might well have been then discussed together.

The second meeting of Section I. was held on the afternoon of the following day, when the proceedings were opened by Mr. A. G. Lyster (the Assistant Engineer of the Mersey Dock and Harbour Board) reading a paper on "Dredging the Mersey Bar." This perhaps was the most important paper of the section, inasmuch as it dealt with a practical example of what is being done to meet the most pressing maritime necessity of the day. In our last issue we pointed out that the naval architect and marine engineer had progressed so far that they had completely outstripped the harbour engineer. Advance in ship construction is really barred by the want of depth of water over dock-sills and at the mouths of ports. This is not only apparent in cross-channel service with small swift packet boats, but also with our great ocean liners. Every increase in size in steamships appears to be attended by success, but limits of draught seem now to stop progress in this direction. A paper by M. Feret on mortar in sea works was also read at this sitting ; a paper by MM. Cimino and Verdinois on rock-dredging at Palermo being taken as read.

The next sitting of Section I. was on the following Thursday afternoon, when three papers were set down for reading. The first taken was by M. P. Demey on ports on sandy coasts ; the second, by M. V. E. de Timonoff, a Russian Professor, having a similar title. The latter contribution was an interesting communication of a general nature, in which the various points involved in the consideration of the subject in regard to tideless seas were considered at large. In the discussion an interesting point was raised by an English engineer, Mr. Wheeler, as to the movement of beach. The matter was perhaps somewhat outside the legitimate scope of the discussion, as Mr. Wheeler attributed the movement of beach to the tidal movement, whilst M. de Timonoff dealt only with tideless seas. Mr. Wheeler said that the travel of beach is always in the direction of the flood—a theory which does not support the author's line of argument ; but it must again be said the action of tide was eliminated from the author's reasoning. A paper by Mr. C. Spadon on the Lido entrance to the port of Venice was taken as read.

The last sitting of Section I. was held on Friday afternoon. Two papers were on the list, one by Mr. A. E. Carey on "La Guaira Harbour Works, Venezuela," and a second, "Harbours and Ferry Systems of Denmark," by the same author.

In Section II. the first meeting was held on Wednesday morning, when the following papers were down for discussion :—"The Docks of Bordeaux," by H. Crahay de Franchemont ; "The Equipment and Working of Ports," by A. Guerard ; "The New Docks of Antwerp," by G. A. Rogers ; and "Hydraulic Installation at the Port of Genoa," by L. Luiggi and E. Borgatti. The next sitting was on the following day, when three other papers were read, viz. :—"The Port of Calais," by A. Charguérand ; "The Port of Dunkirk," by Paul Joly ; and "Lengthening of Leghorn Dry Dock," by J. Inglese. The last day of the meeting was devoted by this section to the reading of papers descriptive of the London Docks, and of the Havre and Alexandra Docks.

In the Shipbuilding Section, Section III., the papers were mostly of a moderate degree of excellence. Mr. A. E. Seaton, of Hull, opened with a good historical paper on "Cross Channel Steamers," which led to an interesting discussion. It was followed by a paper by Prof. Biles, on "Ocean Passenger Steamers." The subject has been so often dealt with, that it is difficult to say anything new upon it. On the following day, Thursday, July 20, Sir Thomas Sutherland, the chairman of the P. and O. Company, gave a general address, after which a paper by Mr. A. Blechynden, on the "Sand-pump Dredger for the Mersey Bar," the vessel already referred to, was read. This is a hopper dredger, and, we believe, the largest in existence, the capacity being no less than 3000 tons. A paper by Mr. Flannery on "The Transport of Oil in Bulk" followed. The subject is one which has been largely dealt with lately, and the author necessarily trod again a good deal of the ground occupied by Mr. Martell at Cardiff the week previously. On Friday, the last day of the meeting, a paper by Mr. C. E. Stromeyer, on "Marine Boiler Construction," was read. The scope was general, and were it not known that the author, from his position at Lloyd's, must be fairly in touch with recent practice, one might almost fancy that he had ceased to study his subject four or five years ago. The most original, and perhaps the most suitable paper to the occasion was that last taken. It was a contribution by Mr. A. Denny, of Dumbarton, entitled "Shipowners and Shipbuilders in their Technical Relationships." The subject is one that may be considered with advantage by both sides.

In the business of this section Dr. W. H. White, the Assistant-Controller of the Navy and Director of Naval Construction, took the leading part, assisted by Mr. G. Holmes, who, as Secretary to the Institution of Naval Architects, was well qualified to conduct the detail business of the section.

Section IV., that devoted to lighthouses, &c., had an attractive programme, but the proceedings were, in some cases, rather disappointing. Our space will allow us to give no more than a list of the papers set down for reading. They were as follows :—"On Compressed-air Fog Signals," by C. Ribière ; "Ship Signal Lights," by J. Kenward. These were taken on the first day, Tuesday, July 18th. A discussion was brought on by arrangement upon "Communication between Lightships and the Shore." The result was disappointing on the whole. The next day a good paper on "Feux-Éclairs, and the Physiological Perception of Instantaneous Flashes" was contributed by M. A. Blondel. M. Bourdelles also gave a paper on "Methods and Formulæ for Calculating the Luminous Power of Lighthouse Apparatus." The following day an interesting and practical paper on "The Illumination of Estuaries and Rivers" was contributed by Mr. W. T. Douglass. Two other papers were on the list for this day, the first on "Harbour Lights, Buoys, and Beacons in Italy," by D. Lo Gatto, and another on "Researches as to Continuous and Alternate Electrical Currents for Lighthouse Purposes," by A. Blondel. The last day of the meeting had three papers down for reading, viz. : "On Recent Improvements in Lighthouses," by D. A. Stevenson ; "Efficiency of Recent Gigantic Lighthouse Apparatus compared with Electric Light," by D. Lo Gatto ; and "Lighting and Light Dues in the Red Sea," by Commander G. Hodgkinson, R.N.

In connection with the Congress there were numerous dinners and other festivities, at which the foreign members were the lions of the occasion; indeed, international courtesy reigned throughout the proceedings. This was carried so far in one section that hardly anything but French was spoken, those who wished to take part in the discussions receiving but little encouragement from the chair unless they addressed the meeting in the French tongue—or, rather, in French words. This was satisfactory to the majority, so far as the remarks of foreign members were concerned; but when the language was exotic in its character to follow was sometimes laborious. This week a series of excursions are being made to some of the chief ports of the United Kingdom.

THE LUMINIFEROUS ETHER.

AT the anniversary meeting of the Victoria Institute on June 29, Sir G. G. Stokes delivered his presidential address. After a few introductory remarks on the functions of the Institute, he said:—"I intend to bring before you to-night a subject which the study of light has caused me to think a good deal about: I refer to the nature and properties of the so-called luminiferous ether. This subject is, in one respect, specially fascinating, scientifically considered. It lies, we may say, in an especial manner on the borderland between what is known and what is unknown. In the study of it it is quite conceivable that great discoveries may be made, and, in fact, great discoveries have already been made, and I may say even quite recently, and we do not at present know how much additional light on the system of Nature may be in store for the men of Science; possibly even in the near future, possibly not until many generations have passed away. I will assume, as what is familiarly known to you all, and what is well established by methods into which I will not enter, that the heavenly bodies are at an immense distance from our earth. More especially is this the case with the fixed stars. Their distance is so enormous that even when we take as a base line, so to speak, the diameter of the earth's orbit, which we know to be about 184 millions of miles, the apparent displacement of the stars due to parallax is so minute as almost to elude our investigation. Nevertheless that distance is more or less accurately determined in the case of a few of the fixed stars. But the vast majority, as we have every reason to believe, are at such an enormous distance that even this method fails with them."

"To give a conception of the immense distance of the fixed stars, I will assume as known that light travels at the rate of about 186,000 miles in one second, a rate which would carry it nearly eight times round and round the earth in that time; and yet if we take the star which, so far as we know, is our nearest neighbour, it would take three or four years for light from that star to reach the earth. Now as we see the fixed stars there must be some link of connection between us and them in order that we should be able to perceive them. Probably all of you know that two theories have been put forward as to the nature of light, as to the nature accordingly of that connection of which I have spoken. According to one idea, light is a substance darted forth from the luminous body with an amazing velocity; according to the other, it consists in a change of state taking place, propagated through a medium, as it is called, intervening between the body from which the light proceeds and the eye of the observer. For a considerable time the first of these theories was that chiefly adopted by scientific men. It was that, as you know, which Newton himself adopted; and probably the prestige of his name had much to do with the favourable reception which for a long time it received. But more recent researches have so completely established the truth of the other view, and refuted the old doctrine of emissions, that it is now universally held by scientific men that light consists in an undulatory movement propagated in a medium existing in all the space through which light is capable of passing."

"This necessity for filling all space, or at least, such an inconceivably great extent of space, with a medium, the office of which, so far as was known in the first instance, was simply that of propagating light, was an obstacle for a time to the reception by the minds of some of the theory of undulations. Men had been in the habit of regarding the inter-planetary and interstellar space as a vacuum, and it seemed too great an assumption to fill all this supposed vacuous space with some kind of medium for the sole purpose of transmitting light. Notwithstanding, even long ago strong opinions were entertained to the effect that there must be something intervening between the different heavenly bodies. In a letter to Bentley, Newton expresses himself in very strong language to this effect: 'That gravity should be innate, inherent and essential to matter, so that one body may act upon another at a distance through a *vacuum*, without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity that I believe that no man who has in philosophical matters a competent faculty of thinking, can ever fall into it. Gravity must be caused by an agent acting constantly according to certain fixed laws; but whether this agent be material or immaterial, I have left to the consideration of my readers.'"

"What the nature of the connection between the earth and the sun, for example, may be whereby the sun is able to attract the earth and thereby keep it in its orbit—in other words, what the cause of gravitation may be—we do not know; for anything we know to the contrary, it may be connected with this intermediate medium or luminiferous ether. There are other offices, we believe, which this luminiferous ether fulfils, to which I shall have occasion to allude presently."

"In connection with the necessity for filling such vast regions of space with this medium, a curious question naturally presents itself. We cannot conceive of space as other than infinite, but we habitually think of matter as occupying here or there limited portions of space, as, for example, the different heavenly bodies. The intervening space we commonly think of as a vacuum, and it is only the phenomena of light that led us in the first instance to think of it as filled with some kind of material. The question naturally presents itself to the mind—is this ether absolutely infinite like space? This is a question to which science can give no answer. Though we cannot help thinking of space as infinite, yet when we turn our thoughts to some material existing in space perhaps we more readily think of it as finite than infinite. But if the ether, however vast the portion of space over which it extends, be really limited, we can hardly fail to speculate what there may be outside its limits. Space there might be wholly vacuous, or possibly outside altogether this vast system of stars and ether there may be another system subject to the same laws, or subject to different laws, as the case may be, equally vast in extent; and if there be, then so far as we can gather from such phenomena as are open to our investigation, there can be no communication between that vast portion of space in part of which we live and an ideal system altogether outside the ether of which we have been speaking."

"But the properties of the ether are no less remarkable than its vast or even possibly limitless extent. Matter of which our senses give us any cognisance is heavy, that is to say, it gravitates towards other matter which agrees with it in so far as being accessible to our senses. The question presents itself to the mind, does the ether gravitate towards what we call ponderable matter? This is a question to which we are not able to give any positive scientific answer. If the ether be in some way or other connected with the cause of gravitation, it would seem more likely that it itself does not gravitate towards ponderable matter."

"Again, we have very strong reason for believing that ponderable matter consists of ultimate molecules. First, that supposition accords in the simplest way with the laws of crystallography. Chemical laws afford still stronger confirmation of the hypothesis, through the atomic theory of Dalton, now universally accepted. Comparatively recently, the deduction of the fundamental property of gases from the kinetic theory, as it is called, affords strong additional confirmation of that view of the constitution of matter. Still more recently, the explanation which has been afforded by that theory of that most remarkable instrument the radiometer of Crookes has lent further confirmation in the same direction. None of these evidences apply to the ether, and accordingly we are left in doubt whether it too consists of ultimate molecules, or whether on the other hand it is continuous, as we cannot help conceiving space to be."

"The undulatory theory of light was greatly promoted in the first instance by the known phenomena of sound, and the explanation which they received from the hydrodynamical theory. Accordingly, since sound, as we know, consists of an undulatory movement propagated through the air (or it may be through other media), and depending upon condensation and rarefraction, it was supposed naturally that light was propagated in a