took up his quarters, and hastily improvising a laboratory, commenced his investigations.

So far the plague had confined itself to the insanitary Chinese quarters of the city; and Yersin mentions that the wretched cabins occupied by the natives were often not only without windows of any kind, but were sunk below the level of the ground, which, combined with the shocking overcrowding which prevailed, converted such dens into plague-incubators of the most fulsome and dangerous character.

In these infected districts, one of the first things which attracted Yersin's attention was the extraordinary number of dead rats which lay about in all directions in the houses as well as in the streets; but, on inquiry, he soon learnt that this rat-mortality was a well-known forerunner of the plague, that the latter usually attacks animals such as rats and mice, and in the country districts swine and buffalos, before it touches human beings. An examination of these dead rats showed that their symptoms differed in no way from those which characterise the plague in man, and the extreme susceptibility of these animals furnished Yersin at once with a valuable means of tracking out the virus. His first step was to make careful examinations of the bubonic material present in the tumours which accompany the disease, and here he discovered immense numbers of a short bacillus which appeared to be almost exclusively in possession of the field. These he found were readily stained, and could be cultivated with ease in the usual bacterial media. Further investigation showed that these same bacilli were invariably present in the ganglia and liver and spleen of plague patients; that they were, however, rarely to be found in the blood, and then but in small numbers, and usually only in rapidly fatal cases a short time before death.

Healthy rats and mice inoculated with pure cultures of this bacillus succumbed to the typical plague symptoms; and Yersin had thus accomplished the first step in his investigation—the identification of the specific virus of plague. Yersin was at first of opinion that rats were the principal disseminators of the disease, for healthy mice shut up with a dead plague-stricken rat, rapidly developed the disease and succumbed; but he noticed later the curious fact that, in the little room where he carried out his *post-mortem* examinations, immense numbers of dead flies were scattered about in all directions. He, therefore, determined to ascertain if this wholesale slaughter of flies had any connection with plague infection; so taking some of these insects, and first removing the head, wings and feet, he pounded up their bodies in broth. An examination later of the liquid exhibited masses of bacilli closely resembling the now familiar plague microbe; to place their identity beyond doubt he inoculated some of this broth into mice, with the result that the latter died of plague. That flies materially assisted in the spread of the disease was thus established.

With the slender accommodation and primitive means at his disposal, it was impossible for Yersin to further pursue his investigations, and prepare a plague anti-toxin, and he, therefore, forwarded cultures of his bacillus to the Institut Pasteur, and from here, in the course of the following year, was published the memoir describing the production of the anti-plague serum which is now being so urgently requisitioned for service in India. The bacillus was found to be pathogenic for not only rats and mice, but for the other animals of an experimental laboratory, rabbits and guinea-pigs.

The attempt was first made to vaccinate these animals by means of the toxin, but filtered cultures of the bacillus produced no effect whatever; so that the plan was adopted of heating cultures to 58° Centigrade, and inoculating the dead bacilli. If the latter are injected in sufficient quantities, they are capable of killing the animal; but if a smaller quantity of the liquid containing them is employed, then it acts as a vaccine, and the animal is protected from a subsequent lethal inoculation of the virus, and its serum subsequently acquires protective properties. From success with small animals the attempt was made to immunise large animals, such as horses. For this purpose virulent plague-cultures, capable of killing a mouse in two days, were employed, and the liquid containing these living microbes was injected into the horse's veins. The reaction was rapid and intense, and lasted a whole week, after which the fever abated, and the animal slowly recovered. A long interval—twenty days—was allowed to elapse before a second injection was attempted; but this time, although an equally virulent culture was employed, in the same quantity as before, the symptoms were less pronounced, and passed away more rapidly, and it was found possible to both gradually increase the quantity and diminish the interval between the several injections. At the end of six weeks the first trial was made of the curative properties already attained by the serum, and the results were regarded as extremely satisfactory and encouraging. To confer immunity to plague infection on a mouse, it required $\frac{1}{10}$th of a cubic centimetre of serum, administered twelve hours *before* the virus was injected; to cure animals after plague infection, 15 cubic centimetres of serum were required to be inoculated twelve hours *after* the virus had been introduced. The large quantity of serum necessary in these first experiments for curative purposes, was due to the short time during which the immunising process had been carried on. It will be remembered that in diphtheria the time required to train a horse's serum up to the proper protective pitch is a question of months, and in the case of anti-venomous serum a matter of as much as fifteen months; thus a treatment of six weeks only is a very short time for the serum to exhibit immunising properties. That the most remarkable therapeutic value attaches to anti-plague serum as now elaborated at the Institut Pasteur in Paris, is shown by the success which has recently followed its application in undoubted cases of plague at Amoy, by Yersin, now Director of a Pasteur Institute at Nha-Trang in Annam.

In conclusion, it may be asked, How long is England to rest content to knock as a humble suppliant at the door of foreign institutes for assistance when overtaken by disaster, as is now the case in India? Why should Paris supply the means for relieving the suffering of our fellow-subjects in India?

The answer and reasons for that answer are, alas! but too well known to require repetition here; and we can only hope that in the future, at present dim and obscure, the barriers which now so formidably impede medical progress in this country may yield before the enlightened pressure of public opinion.

G. C. FRANKLAND.

THE "BAZIN" ROLLER BOAT.

IN NATURE of December 3, 1896, we gave a short notice of the new roller-boat the *Ernest Bazin*. From a paper recently read at the Society of Arts by M. Emile Gautier (*Journal* Society of Arts, January 22), the following further particulars are taken.

The *Ernest Bazin* was launched a few months ago at Saint-Denis, and was then taken down the Seine to Rouen, where she is being fitted with her engines and machinery. As soon as these are completed an experimental trip will be made across the Channel, and it is anticipated that the vessel will in the course of about six weeks be anchored in the Thames. This experimental vessel has a displacement of 280 tons; its length is 131 ft. 3 in., and width 38 ft. 9 in. The framework and hull are supported on six lenticular hollow wheels 32 ft. 10 in. in diameter, about one-third of which will be immersed. The engines, cargo, cabins, &c., are placed on a platform resting on a framework carried on the axles of the wheels. The engines are constructed to develop 750 horse-power; 550 of which will be used for the propeller, and 200 horse-power for driving the three pairs of wheels. With this power an ordinary steamer of a similar tonnage would not steam more than 18 or 19 knots. It is expected that the *Ernest Bazin* will attain double this speed. The principle on which the vessel is constructed is the substitution of the rolling motion of great wheels for the ordinary gliding motion of the hull of the vessel through the water, in order to minimise friction. An ordinary ship with its hull gliding through the water represents the disc pushed forward without a rotary motion being imparted to it. As it is compelled to cut the water in front of it, and to drive it back longitudinally, it would soon cease to move forward did it not receive a fresh impulsion at every moment. If, however, the vessel were supported by revolving buoys, it is contended that it would possess all the advantages of the disc, to which a rotary as well as a forward motion is given. The effort, instead of being exercised longitudinally, is exercised partially downwards, vertically, so that the resistance is reduced in a considerable degree.

As the result of calculation the rotary speed of the wheels has been made one half greater than the speed of translation.

In the discussion which followed the reading of the paper, the speakers, while declining to prophesy as to the results to be attained, seemed to be of opinion that the difficulty of construction would increase very rapidly with the increase in size, owing to the great strain which would be imposed on the

platform in rough weather, and that to obtain the necessary strength the weight would become excessive.

Practically the carrying part of the structure rests on six floating vessels coupled together by a framework. It does not follow that because this principle as applied to the lightly-constructed canoes used by the natives of the Polynesian Islands is successful, that it could therefore be applied to the enormous structure required for an Atlantic liner. The *Calais Douvre* and other coupled boats which have been built for the cross-Channel passage, have certainly not proved a success.

M. Bazin, the inventor, is an engineer well known in France for the originality of his ideas, and for the invention of a submarine machine that served for the attempt to raise the Spanish galleons sunk in Vigo Bay; also for inventions in connection with gold-washing machinery, dredgers, cranes, &c. His roller-boat will no doubt attract a great deal of attention when it arrives in the Thames.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The degree of Doctor of Science will be conferred on Dr. Nansen at a special congregation to be held at 1 p.m. on March 16.

Prof. E. E. Barnard, of the Yerkes Observatory, Chicago, is to exhibit his photographs of the Milky Way, and other celestial objects, in the Lecture Theatre of the Cavendish Laboratory, at 4 p.m. on February 20.

Dr. A. C. Haddon is this term giving two well-attended classes (one elementary and one advanced) in physical anthropology at the Anatomy School.

An examination for scholarships and exhibitions in natural science and engineering will be held at Trinity College on March 15. Details may be learned on application to the tutors.

THE Cornwall County Council have had to further increase the salary attached to the lectureship on fisheries to £350 per annum, to enable them to secure a competent instructor.

AT a meeting of the Council of the Royal College of Surgeons, on Saturday last, the following resolution was adopted (subject to the approval of the Royal College of Physicians): "That the Royal College of Physicians of London and the Royal College of Surgeons of England, in full accord with their previous action, express the earnest desire that her Majesty's Government will, at the earliest opportunity, reintroduce a Bill for the reconstitution of the London University by statutory commission on the general lines of the report of the Cowper Commission, and do assure the Government that such a course will have their approval and support." It was further resolved that if the Royal College of Physicians adopted the foregoing resolution, copies of it should be forthwith forwarded to the Lord President of the Council, Mr. Balfour, and the Senate of the University of London.

A PLEA for the establishment of a National University at Washington is made in *Science* of February 5. It is suggested that the University should be developed from the national institutions already existing at Washington. "Workers in the different Government divisions and others having the proper preliminary education could, on presenting a thesis showing original work and passing an examination, receive the doctorate of philosophy, and this would qualify them as a civil service examination for promotion. The present Commissioner of Education, and perhaps the Regents of the Smithsonian Institution, could govern the University. Examiners could be appointed from leading representatives of science and learning, who would meet yearly for a week of convocation in Washington. We believe that, without radical changes, and with nominal expense, there could be established at Washington a National University likely to become the world's greatest University."

AN annual report, received a few days ago, tells us that the past year was more than usually interesting in the history of the Glasgow and West of Scotland Technical College, as being the centenary of the foundation of Anderson's College, which received its charter of incorporation from the magistrates of the City of Glasgow on June 9, 1796. Besides being the oldest member of this composite institution, the interest attaching to Anderson's College—apart from the fame of its medical school, now a separate institution—lies in the fact that it was the progenitor of mechanics' institutions and the pioneer of technical education in this country. The record of successes of past and present students testifies to the soundness of the instruction given. The College is extending its operations rapidly over the West of Scotland, and, as its name implies, it is now more than a Glasgow institution. We notice that Mr. G. F. Scott Elliot has been appointed lecturer in botany, in succession to the late Mr. Thomas King, who occupied that position for many years.

THE fifth annual report of the Technical Instruction Subcommittee of the City of Liverpool, which has reached us, shows that the high standard of efficiency was maintained during 1896. Most educationists will agree with the Chairman, who says, in his prefatory remarks, that "it will be a considerable advantage to the cause of higher education generally when it is recognised, by legislative authority, that specialised technical instruction can only properly be carried on as part of a general scheme of secondary education, and when means are provided for encouraging and developing general secondary education without attempting to force it too soon towards specialisation." The detailed report of the Director shows that no part of the legitimate work of a local system of technical instruction has been neglected. The teaching of science and modern languages has been further improved and developed in the secondary schools, special attention being very properly directed towards the provision of every convenience for the necessary amount of practical instruction in chemistry and physics. Side by side with this provision for young boys and girls, we find an efficient system of evening classes in commercial and technical subjects for young men who have started upon the serious work of life. The Committee have shown their appreciation of their good fortune in having a University College at hand by helping it to the extent of £1700 during the past year, which has been marked by a much needed extension of the chemical laboratories, and by the establishment of a new Natural History Museum.

SCIENTIFIC SERIALS.

Bulletin of the American Mathematical Society, January.—"On the stability of a sleeping top" is the abstract of a lecture delivered by Prof. Klein before the Society at the Princeton meeting, October 17, 1896. It will be remembered that Prof. Klein delivered four lectures "On the theory of the top," at the sesquicentennial celebration of the University. In these latter an attempt was made to simplify the formulæ for the motion of a top by turning to account the methods of the modern theory of functions. The later lecture before us considers from the same standpoint a much more elementary question, viz. the stability of a top rotating about an axis directed vertically upwards. The point of support is supposed to be fixed. When the rotation is very rapid the behaviour of the top is as if its axis were held fixed by a special force. Some interesting results are arrived at.—Bibliography of surfaces and twisted curves, by Dr. J. E. Hill, consists mainly of extracts from a paper read before the Society in May last. It attempts to represent a compilation and classification of all articles, with certain exceptions, upon these surfaces and curves which have been published during the present century. The paper itself should be, judging from these extracts, extremely useful to students.—Linear differential equations is a review, by Prof. M. Bôcher, of Schlesinger's "Handbuch der Theorie der Linearen Differentialgleichungen," and, like the previous work by Prof. Bôcher in the *Bulletin*, is thorough. The writer's conclusion is that though the book fails to meet some of the demands which it seems to him may fairly be made of a handbook, it is certain to fill an important place in a mathematical library, owing to the great amount of information which it contains in accessible form.—Messrs. R. W. Willson and B. O. Peirce furnish a table of the first forty roots of the Bessel equation $J_0(x) = 0$ with the corresponding values of $J_1(x)$. This is a paper which was presented to the Society at its summer meeting, September 1, 1896.—The final article, not counting the notes and publications, is entitled "Notes on the Theory of Bilinear Forms," and is by Prof. H. Taber. It was read at the November meeting.

Wiedemann's Annalen der Physik und Chemie, No. 2.—On the dissipation of electricity from a conductor into the air, and on the influence exerted by an increase of temperature of the conductor upon this process, by A. Oberbeck. A thin wire, to which an electric charge is imparted, loses its charge more