of the skin with a very small dose of living bacilli, now are resistant to very large doses. This immunity is not associated with the appearance of antibodies in the blood. It is evident, therefore, that in order to obtain immunity against anthrax it is necessary to increase the resisting power of the special tissue, namely, the skin which the *Bacillus anthracis* favoured.

Prof. Besredka then turned his attention to other diseases, such as cholera, typhoid and dysentery, the organisms of which attack the lining cells of the intestine. If the same principle maintains in these diseases, then in order to produce an immunity it would be best to vaccinate the intestinal wall by bringing the vaccine of killed organisms in direct contact with it. Experiments on animals have shown that such an immunity can be obtained by administering the vaccines by the mouth instead of injecting them subcutaneously by the usually accepted method. Such an immunity, according to Prof. Besredka, is the direct result of the action of the vaccines on the intestinal cells, and not of their absorption into the blood.

Having obtained these results in animal experiments, attention was directed to human beings, and already certain data have been collected which can be interpreted as indicating that, during outbreaks of typhoid and dysentery, those who come in contact with the sick can be protected by the ingestion of tablets of killed bacteria. Arrangements have been made by the Health Section of the League of Nations to carry out an investigation on a much larger scale in the case of outbreaks of cholera in Russia. Another application of this principle which is being investigated is the possibility of vaccinating the skin of human beings against staphylococci, the cause of boils and furuncles. In these cases the organisms develop exclusively in the skin, and already evidence is accumulating that protection and even cure can be obtained by applying vaccines to the skin in place of inoculating them subcutaneously according to the generally accepted procedure.

Prof. Besredka's views are undoubtedly revolutionary and, should they ultimately prove sound, are of the greatest practical importance. The inoculation of vaccines subcutaneously is followed by considerable local reaction and discomfort, and sometimes by actual illness, whereas their local applications to the skin or their oral administration give rise to practically no unpleasant symptoms. It is evident that it would be much easier to induce people to be vaccinated in these circumstances.

Obituary.

PROF. MARCUS M. HARTOG.

BY the death of Prof. Marcus Manuel Hartog in France, at the age of seventy-five years, biological science loses a remarkably accomplished and enthusiastic worker. After a school education in London, he went up to Trinity College, Cambridge, and in 1874 was placed in the first class in the Natural Science Tripos. To many of his old friends it has seemed that if Hartog had had the chance of remaining in Cambridge a year or two after he took his degree to initiate and develop some line of research, he might have attained a position of the highest distinction among the group of Cambridge scientific men of that period ; but having married a few months after graduation, he accepted the post of assistant to the Director of the Peradenya Gardens in Ceylon and never resided again in Cambridge. On his return from Ceylon in 1877 he was appointed demonstrator and lecturer in natural history in the Owens College, Manchester, a post which he held until he was appointed to the chair of natural history in Queen's College, Cork, in 1882.

The writings of Prof. Hartog on biological subjects are so widely scattered in English and foreign periodicals that it would be difficult to make a complete list of them, but it may be said that the principal subject which seemed to dominate his mind was the mechanical or chemical conception of some of the more important vital processes. For dealing with such subjects Hartog was particularly well equipped, having a wide knowledge of both botany and zoology and a love of dealing with abstruse philosophical problems. His explanation of the cytoplasmic figure of the dividing cell, published in the Proceedings of the Royal Society in 1904, as a strain figure under the action of a dual force analogous to magnetism, which he called " mitokinetic force," was the result of a long series of careful experiments and profound philosophical consideration. His two papers published in the *Quarterly Journal of Microscopical Science* in 1891 and 1904 on some " Problems of Reproduction " included valuable criticisms and summaries of the results of the researches by various authors of that period, enlightened by the results of his own special work on the developing egg-cell and his keen critical powers.

Hartog was an enthusiastic member of the British Association, and at almost every meeting held within the British Isles he read a short paper on some investigation upon which he had been engaged during the year. At the Bradford meeting in 1900 he discussed the bearing of his discovery of the presence of a peptic zymase in the developing embryos of the frog and the chick, and expressed the conclusion derived from it that a cell which only accumulates reserve material has no need constantly to readjust its surface to its volume, but when a zymase is formed and it is able to use its reserves, the need for augmented surface asserts itself, and we get cell division.

There is not much from Hartog's pen on systematic zoology, but from the time when he was a demonstrator in zoology in Manchester he took a special interest in the Acinetaria, and at different periods he made several communications on the species and on the structure of this small group of Protozoa. Students of zoology are also indebted to him for the excellent accounts he wrote of the Protozoa and Rotifera for the " Cambridge Natural History."

Without in any way underrating the value of the work Hartog was able to accomplish during a long and active life, it may be felt that had he not been constantly harassed by his manifold duties as professor of three subjects and the want of adequate assistance and resources, his record would have been much greater and more important. He retired from the chair in Cork

in 1921 and went to live at Meudon near Paris, where he died on January 21 last. He leaves a widow, one son, and one daughter, the wife of Prof. W. Cra p of the University of Birmingham.

PROF. H. J. HAMBURGER.

HARTOG JACOB HAMBURGER was born at Alkmaar, a small town in the north of Holland, on March 9, 1859, and received his early scientific education from Dr. J. D. Boeke at the "Hoogere Burgerschool," where he was the most distinguished pupil of that eminent teacher. From school he passed to the University of Utrecht in 1879 and, as a student of chemistry, obtained his doctorate four years later. Trained as he was in the severe discipline of physics and chemistry (knowledge to stand in good stead later), other, and perhaps wider questions attracted him, for we find the subject of his thesis was "The Estimation of Urea in Urine."

During this period Hamburger was appointed assistant to Donders for physiological chemistry and to Engelmann for physiology and histology. From them, and through association with them, he obtained his first insight into, and that lifelong love of biological investigation which formed his subsequent work. One particular incident is worth recalling. In 1883 Donders attended a meeting at Amsterdam where de Vries delivered a lecture on plasmolysis. Returning to Utrecht, Donders told his young assistant about it, and the latter immediately applied himself to the somewhat analogous problem of hæmolysis, a question which, extended to the broader aspect of permeability, formed the basis of more than twenty-five years' steady and brilliant research.

After working with Donders and Engelmann for seven years, Hamburger obtained his doctorate of medicine, and in January 1888 he became lecturer in physiology in the Veterinary School at Utrecht, where he remained for thirteen years and occupied himself with such problems as respiration, red blood cells, lymph, and permeability. In 1891 he married Miss F. C. Gosschalk, who was a constant help to him, especially perhaps on the literary side of his activities.

The year 1901 saw Hamburger's appointment, in succession to Huizinga, to the chair of physiology at Groningen, a post he held to the end. Once more we find his outlook expressed in the subject of his inaugural lecture on December 28 of that year, namely, "Physical Chemistry in Medical Science," a subject singularly appropriate to his own research work. Thanks to the personality and assiduity of the new professor a modern Institute of Physiology was erected to replace the building originally equipped during the time of van Deen. This institute is still regarded as a model, and the final tribute of respect of his fellow-workers was reflected in the election of Hamburger as president of the International Physiological Congress, which he received at Groningen in 1913.

The contributions of such an arduous worker as Hamburger cannot be detailed here, but one can note his largest and most ambitious publication, "Osmotische Druck und Ionenlehre in der medizinischen Wissenschaften," produced between 1901 and 1904, only a short time after the fundamental work of Svante Arrhenius on ionic dissociation in liquid media. This and his "Physikalische chemischen Untersuchungen über Phagocyten" are quoted as revealing in no uncertain way the conception of the chemist and the physicist in the scientific objective of Hamburger. Even in the latest work from his laboratory on the elusive question of the biological behaviour of stereoisomeric sugars, one can see the desire to seek explanation on similar lines. A summary by himself of his latest views will be found in the *Lancet*, 1921, ii. pp. 1039 *et seq.*

An attitude such as this must necessarily, and perhaps correctly, entail opposition, but inspection will show the ingenious and simple (and by being simple all the more ingenious) experiments devised by Hamburger and by his school. As an antagonist he was kindly, and the writer treasures several long and careful letters from him on a point raised in conversation regarding some of his work. Such tolerance and patience was characteristic. His own and other countries bore witness to his scientific attainments. Member of the Royal Academy, Amsterdam, he was the recipient of honorary degrees, and a welcome lecturer in England and in America. In terms of years alone he was not an old man; he was but sixty-five; however, after the death of his wife last November he lost much of his wonted enthusiasm for work, his optimism disappeared, his health broke down, and on January 4 he passed away.

Holland as a country is singularly fertile as a source of men of genius. Not the least of this brilliant company was Hamburger. Those of us who were privileged to count him a friend know too well the loss that science has suffered. Physiology is not quite the same without him. J. A. H.

M. ARNAUD DE GRAMONT.

BY the death of Arnaud de Gramont on October 31 last, at the age of sixty-two years, spectroscopy has suffered a loss which it can ill afford. The chief feature of M. de Gramont's work was the investigation of the best means of producing spectra of various types and of the characteristics of the spectra yielded by substances under different modes of excitation. In this somewhat restricted but extremely important department of spectroscopy, he probably achieved more than any other single worker. His earliest efforts were devoted to synthetic chemistry and pyroelectricity, but he soon turned his attention to the subject with which his name is always associated. Spark spectra were the subject of most of his researches, and he early succeeded in devising a method of producing the spark spectrum of a liquid, uncontaminated by the lines of the metallic electrodes employed. Following the work of Schuster and Hemsalech on the effect of self-induction on the spectrum of an electric spark, de Gramont pursued the subject still further, particularly with regard to the spectra of compounds—the so-called "dissociation spectra." He gave great attention to the spectroscopic examination of minerals, embodying the results of his investigations in a very valuable book on the subject.

One of the most useful of the experimental processes which we owe to him is a convenient method