of cases of cholera nostras: we observed them both directly in the intestinal contents, and by cultivation experiments, and studied their characteristics.

3°. Both these comma bacilli are vibrios, which form genuine spirilla. As well in this stage, as in the variations which the form undergoes, are the two vibrios similar.

4°. The behavior under cultivation of the two organisms is almost identical. They vary only under very limited differences of culture media and temperature: and the differences consist not so much in *absolute* as in *relative* variations; i.e., greater energy of growth and vitality of the vibrio of cholera nostras.

5°. Of the physiological properties of the vibrios we have especially remarked — and have clearly determined — their marked resistance to drying, varying temperature, and '*fäulniss*.'

6°. We claim the possibility of a resting stage, and consider it probable that this resting stage is similar to that of other micro-organisms.

7°. Both vibrios are pathogenic.

8°. The pathogenic property of Koch's vibrio is greater than that of the vibrio of Finkler and Prior. There is here also merely a *relative* difference.

9°. The pathogenic property does not exist for all species of animals: much the greater number possess an immunity against both vibrios; they are also pathogenic only under certain conditions. The susceptible animals, and the conditions for producing positive results, are the same for both vibrios.

10°. The symptoms produced in animals by these vibrios have great similarity to those of cholera in man; they are not specific, however, but can also be produced in guinea-pigs by other infectious materials and chemical poisons.

11°. The causal connection between the comma bacillus and cholera asiatica is rendered probable by its constant presence, but is not made certain by the results of inoculation experiments. The causal relationship between the comma bacillus discovered by us and cholera nostras, is rendered probable, first, by the discovery of the micro-organism, and, secondly, by the very great similarity between the symptoms of cholera nostras and asiatica, as well as by the similarity in biological and pathological properties of the two comma bacilli.

12°. The two vibrios can pass into the blood after injection into the intestine, and can be excreted in the urine. The situation of Koch's vibrio in the body so increases its rapidity of development, that a new point of resemblance under cultivation between the two vibrios is furnished.

These conclusions are all supported by the work which is recounted in the text, and which gives evidence of great care and much labor. As will be seen, the claim of identity between the two organisms is abandoned by the discoverers of the later one; and the differences are brought out as well as is possible at the present time. The strong point made by Johne and others of the constant difference in appearance of gelatine-cultures of these two organisms of the same age, is refuted by the authors, and would certainly seem to be completely upset if the figures they give be exact reproductions from nature. At least the differences in appearance between colonies in gelatine of the same age, cannot be taken as *diagnostic*, as some writers upon the subject would have had us believe. There are a number of very fine plates which accompany the book, and give beautiful representations of the microscopic appearances of the two organisms.

The work is very creditable to its authors in every way, and is truly refreshing to read after seeing all the hasty work that has been rushed into print upon the same subject. It cannot be said, of course, that the absolute specific nature of either of the bacilli under consideration has been determined — the positive results of the inoculation experiments were not sufficiently numerous to permit that. It is perfectly true, however, that this work has assisted materially establishing the *probability* of their specific nature; and certainly results of such excellence can but do good in forcing others to attempt the same.

THE COAST-SURVEY AND 'POLITICAL SCIENTISTS.'

THE following letter from the New-York *Evening post* of Sept. 10 is in reply to an article in the same journal for Aug. 13, and reprinted in the *Nation* for Aug. 20. We reprint it here for the interest that it has to scientific men, and desire to call the attention of persons connected with the government to the passage which we have taken the liberty to print in italics.

The article on 'Political scientists' in the *Evening post* of Aug. 13, while it contains many wholesome truths concerning the management of scientific affairs in Washington, reflects with unnecessary severity on the administration of the coast-survey. This article, so far as it concerns the survey, is based upon a report drawn up by a committee of treasury experts, who condemn alike the organization, the methods and the expenditures of the coast-survey. While giving due weight to certain features of their report, we cannot expect that a committee so constituted, however competent to judge of business methods, should know the value of the scientific work upon which, from their point of view, money has been squandered.

Even when their criticism is just, the fact remains that the late superintendent is in no way responsible for the rules which control the general direction of his bureau. He inherited from his predecessors the superintendence of an old and well-trained *personnel*. This has not been materially changed during his administration. Mr. Hilgard did not enlarge the field of operations, but limited himself to the carrying out of plans already formed. In obtaining the appropriations necessary to this end, he relied greatly on the advice of his principal assistants.

In this connection it may be added, that the coast-survey is the only scientific bureau the appropriations for which are distinctly allotted to special objects.

The superintendent has, therefore, little liberty of action. For instance, the very sums devoted to pendulum experiments, so strongly condemned by the committee, must have figured in the estimates submitted by him to congress. Neither could Mr. Hilgard be expected to reduce the coast-survey force, when appropriations, insufficient, it is true, to keep the force fully employed, were distinctly made to pay the salaries of the employees who had grown old in the service of the government. The publications of the coast-survey only contain communications strictly relevant to such investigations as were authorized by the appropriations. As to the experts living at a distance from Washington, such specialists have always been employed by the coast-survey. They have usually received a very moderate compensation for work carried on in addition to their usual avocations, — work which could not have been done otherwise except at great expense.

The article in the *Evening post* implies that the coast-survey has been a party to the distribution of scientific salt in the shape of gifts, such as photographs, chromo-lithographs, illustrated books, and the like, and has also done its full share in the way of personal favors to congressmen. Whatever have been the failings of the administration of the coast-survey, there never has been a 'political scientist' at its head; and the above charges are, so far as I know, absolutely false. My belief is based on an intimate association of many years with this department of government work.

The method of investigation adopted in this case seems somewhat autocratic. Even at this day the superintendent has not seen or been able to obtain a copy of the charges brought against him, having merely been requested to reply in writing to a number of questions. He himself, as well as the assistant in charge of the office, the disbursing agent, and the chiefs of two divisions, were suspended: in other words, disgraced, if not dismissed, before the investigation was begun. Some of these officers had served the department faithfully and intelligently for nearly forty years. Such off-hand condemnation of a bureau from which so much work has gone forth of a character most honorable to the science of the country, is surely to be deprecated in itself, and can hardly be considered by scientific men as less than an outrage upon them all. They have a right to ask that the wholesale imputations thus cast upon official science should be carefully verified before they are accepted.

Thus far the scientific public has received the report of the commission through the newspapers alone, and the press has been liberally supplied with inaccurate and *ex-parte* statements in regard to the investigation into the coast-survey affairs. Their dictum upon the late superintendent, at least as far as his professional career is concerned, is answered by his position as an investigator in the scientific world. In this jury, called for the express purpose of deciding upon the value and efficiency of scientific work, men of science have had no voice.

On several occasions attempts have been made, through the medium of the National academy of sciences, to revise the organization of the scientific bureaus according to a comprehensive plan, which might remedy the evils of the present system. A committee of congress has at last taken up the matter, but nothing of value has as yet been effected; nor have the recommendations of the academy had the least weight with government officials, or with members of congress. No member of the cabinet has availed himself of its councils, though the academy was especially chartered by congress to be the scientific adviser of the government. Since its organization, superintendents of the coast-survey, of the nautical almanac, of the signal-service, of the geological-survey, and of other scientific bureaus, have been appointed without consultation with the men of science in the country.

We do not ask that a scientific bureau should be absolved from the requirements of ordinary business methods, or that the dictates of common sense should be forgotten in its administration. Scientific men can only sympathize with the efforts of the administration to reform the management of the scientific bureaus at Washington. They protest merely against ignorant interference with scientific affairs. Is the superintendent of the coast-survey, the head of the nautical almanac, the director of the geological-survey, or the secretary of the Smithsonian, to submit the scientific expenses of these bureaus to the judgment of a clerk in the auditor's department? The necessary appropriations having been made, is that department, or any member of it, to decide upon the value of the scientific work thus provided for, or upon the method of its execution? Surely such an alternative would be worse than the state of demoralization said to exist now in our scientific bureaus. If this be the nature of the contemplated changes, they can only be dreaded by the friends of science.

The surveillance can hardly be too strict; but let it be intrusted, so far as scientific work and methods are concerned, to men who have some training in both. Undoubtedly there is much which should be changed at Washington with a view to introducing a proper co-ordination among the different scientific bureaus. But the blame for this does not rest on the 'political scientist' alone. The former secretaries of the interior, of the treasury, of war, and of the navy as well as congress, are partly responsible for the existing confusion and inefficiency; they have tolerated a duplication of work which has little by little brought about the present state of things.

One word more as to the character of the work done by the coast-survey. Professor Bache himself was perhaps the most successful of all the heads of our scientific bureaus, in obtaining from congress the appropriations necessary to the maintenance and efficiency of his department. He and Peirce originated the very scientific investigations now decried by the committee. Their successors have only carried out the methods and the physical experiments which they deemed necessary. Are these to be abandoned because a treasury expert has seen fit to condemn valuable experiments, and to indulge in a few cheap jibes about 'swinging the pendulum?' That he

should not see the use of such experiments in the natural. To one who does understand their immetance, the wonder is that such an opinion slathave any weight in such a matter. The standard the early days of Bache is still the standard of a coast-survey work of to-day. Let us hope that ignorant criticism will have power to lower or i pair the efficiency of a department of whose scientil record the country may well be proud.

While criticising the article of the *Evening post*, so far as it relates to the coast-survey, let me express my complete agreement with its condemnation of the 'political scientist.' It is time that the system thus attacked should be abandoned, and that indiscriminate scientific assistance, given by the heads of bureaus to institutions and individuals, and never contemplated or sanctioned by congress, should be discontinued. It has brought nothing but discredit upon the official science of the country. Let the most liberal appropriations be made for the work of our scientific bureaus, but let the requisitions be so complete and detailed as to invite a fair and open criticism.

ALEXANDER AGASSIZ.

Cambridge, Mass., Sept. 9.

THE THEORY OF VOLCANOES.

THIS work is a brief statement of the most general facts relating to volcanoes, with the citation of many examples of volcanoes of various classes, and their subordinate phenomena, by way of illustration. It is evidently intended for the most intelligent class of general readers, though valuable also to the specialist.

In the first chapter, Mr. Vélain describes the phenomena attending a volcanic eruption of the normal type, and with great propriety treats such an occurrence as a manifestation of the energy of the elastic vapors contained in the erupting materials, — a fundamental fact which should always be impressed as forcibly as possible upon the general reader. He also describes the various forms given to the lavas, the modes of accumulation of volcanic piles, the formation of cinder-cones, and the many forms of craters. He gives descriptions of some of the more remarkable eruptions of which records have been preserved, and these are chosen so as to illustrate the typical cases of the several classes of volcanoes. In this chapter may be found much information about volcanoes not described in English treatises on this subject, such as those of Reunion and the Island of St. Paul.

The second chapter, on the gaseous emanations, is, to the American student, probably the most instructive one in the book. The investigations of Charles Saint-Claire Deville, of Scacchi, of Fouqué and Levy, are set forth in considerable detail, and well summarized. These are of great importance, and have, no doubt, received less attention from writers in the English language than they are entitled to. It may be remarked, however, that much more extended observations upon this class of phenomena are needed than those upon which the conclusions of Deville and Fouqué are founded. The pre-eminence of those investigators is a high warrant for the validity of their conclusions; but the experienced vulcanologist will perhaps feel that they are even more systematic and beautiful than he is accustomed to find volcanic phenomena to be, and he would like to see them tested by the widest possible verification. The whole chapter is admirable reading, and excellently arranged by Mr. Vélain.

The third chapter describes the lavas themselves, their methods of flow, and the forms they assume at solidification. Very little effort is made to describe the micro-characters of the lava, and this was probably judicious on the author's part; for these characters cannot be briefly summarized, and any attempt to do so would have exceeded the scope of his work.

The fourth chapter treats of the geographic distribution of volcanoes. The main fact he seeks to establish is, that volcanoes are, with the rarest exceptions, situated near the sea, or within it. At considerable length, and with reference to this generalization, he passes in review all the lines of active vents in the world. As a mere statement of facts, apart from any conclusions, his summary, though not free from errors, is a valuable one on many accounts: considered with reference to his generalizations, his treatment of the subject is open to grave criticism. One of the most important and comprehensive propositions he insists upon, is the linear arrangement of volcanoes. This idea has certainly a large amount of truth in it, but it has been enormously overloaded and overworked by writers of general treatises. The occurrence of half a dozen to a dozen small cones upon a single line of fracture twenty-five to a hundred kilometers in length, is very frequent in districts where the volcanic action has been diffuse. But a linear arrangement on a grand scale is another matter. The strongest case of it which can be cited is in South America, where many volcanoes are scattered in a most irregular array along the Andes; but no evidence has yet been brought to light, that any six, or even any three, of them have been built

Les volcans, ce qu'ils sont et ce qu'ils nous apprennent. Par M. CH. VÉLAIN, docteur des sciences, maître de conférences à la Sorbonne. Paris, *Gauthier-Villars*, 1884. 8°.