spondence with La Marck seems to have prejudiced him against the 'moral' characters of the revolution, — Necker, Bailly, and Lafayette, — whom he scarcely mentions without a sneer. The removal of the king and assembly to Paris is put down to "the extreme vanity of Lafayette, who wanted them there merely to increase his own honor and glory." The starvation "gave Lafayette an opportunity to pose as savior of the monarchy." In the matter of the suspensive veto, Necker "acted vainly and foolishly on the plan which Lafayette had vainly and foolishly invented." What was criminal in Lafayette at the Hotel de Castries, it becomes a virtue in Mirabeau to defend. In short, Mr. Stephens feels something of the rancor which Mirabeau felt when "every attempt of Mirabeau to unite himself to Necker and Lafayette had been spurned by those vain and conceited men." On the other hand, the double dealing of Mirabeau when he was in the pay of the court is put down as masterly statesmanship, and his want of principle is almost made a proof of his greatness. Nothing is said of the difficulties of Lafayette's position, which exposed him to attack from both sides; of his chivalrous loyalty to the court, yet sympathy with the popular cause; or of the high opinion entertained of him by the best contemporary critics.

There is much new and interesting matter in the account of the elections to the states-general, and of the local *cahiers* of grievances. Mr. Stephens is a lover of exact detail, perhaps at times overloading his history with biographical minutiae. There are also sketches of the economic and financial state of France in connection with the views of the foremost thinkers (to whom the evils of the internal *douanes* suggested the doctrine of free trade), showing the results of the issue of a paper currency and of the wasteful system of taxation. The theory (p. 176) that the burning of châteaux was due to the desire of the copyhold tenants to get possessionof their court-rolls seems a little strained to any one who has read contemporary accounts of the condition of the French peasantry. Points made very clear are the unpractical character of the constituent assembly, with its 'theory of irregular verbs,' — the reasons why it was left behind by the provinces in the march of ideas, — and the widening gulf between the *bourgeois* and lower classes, especially the *ouvriers*, who suffered from protective trade associations.

Enough has been said to show that Mr. Stephens has produced a work which promises to rank among the standard authorities on the period, and which will be of sterling historical value to the student of modern democracy.

VINES'S LECTURES ON THE PHYSIOLOGY OF PLANTS.

THERE has long been felt the need of a good text-book on vegetable physiology in the English language, and hence we heartily welcome the appearance of this excellent treatise. The investigation of the phenomena of plant-growth, nutrition, respiration, metabolism, reproduction, etc., has of recent years been almost entirely accomplished by the Germans, and the prominent part they have taken in these researches will be at once apparent to the reader of Professor Vines's work. As the title indicates, the volume is an expansion of the author's lectures on the subject, and these are twenty-three in number. Nearly ten years have elapsed since its preparation was begun, ill health and the pressure of official duties having retarded its publication.

Lecture I., as introductory, treats of the general features of the vegetable cell, its cell-wall, and its contents, Protococcus and yeast being used as examples with references to the tissue systems of multicellular plants. Then follow two chapters on the structure and properties of the cell, in which are discussed the growth, thickening, and lignification of the wall; its optical properties; and its incrusting mineral matters, — oxalate and carbonate of lime, and silica; the protoplasmic contents and the nucleus; the vacuole and the cell-sap. The molecular structure of organized bodies is then considered. An account is given of 'imbibition,' or capacity of organized matter for absorbing water. The rival theories of Naegeli and Strasburger are compared; and the latter appears to be favored by the author, though farther on in the book reference is made to Naegeli's *micellar* hypothesis. In this connection allusion is made to Hale's old experiment of putting peas to soak in an iron pot with a leaden cover on which was placed a weight of 184 pounds: the force generated by imbibition was sufficient to raise the cover and weight. Here we also find an instructive discussion of the osmotic properties of the cell, and it is pointed out that substances may be transferred from cell to cell by means of the connecting threads of protoplasm as well as by osmosis.

Lecture IV. is on the absorption of water by root-hairs and the epidermal cells of rootlets, and is full of important information for the agriculturist. The structure of soils, the action of acid cell-sap, which saturates the absorbing organs and brings salts insoluble in water alone into solution, are described, and numerous analyses of the ash of plants are given. The discussion of the absorp-

Lectures on the physiology of plants. By SYDNEY HOWARD VINES. Cambridge, *University press*, 1886. 8°.

tion of gases through stomata and lenticils is given in lecture V. It has long been known that under certain conditions some plants absorb oxygen: this is most markedly true of fungi; and Professor Vines states (p. 76) that it appears that the power of absorbing this gas is possessed by all plants, sustaining this conclusion by the experiments of Wolkoff and Mayer on seedlings, those of De Saussure, Oudemans, and others on germinating seeds, and of De Saussure on many flowers. It also appears, that, if roots are not supplied with oxygen, the plant soon becomes unhealthy, and ultimately dies. Portions of plants which contain chlorophyl abundantly, absorb oxygen in darkness, while this is given off during their exposure to sunlight. All green portions absorb carbonic acid in sunlight. Ammonia also is taken from the atmosphere, as has been shown by Ville; but free nitrogen is apparently not thence absorbed, the presence of this gas in the cell-sap being accounted for by its solubility in water.

Lecture VI. is on the movement of water in plants. A very clear account of this phenomenon is given, the circulation being regarded as passing mainly through the cell-walls of the lignified tissues. Transpiration, or the exhalation of watery vapor from the leaf surfaces, is treated of in the seventh lecture, and the food of plants in the eighth.

The next six chapters are devoted to the metabolism of plants, — the changes which materials undergo in the tissues under the influences of light, heat, chemical affinity, etc.; and these are perhaps the most valuable parts of the book. Here the discussion begins with the consideration of the formation of non-nitrogenous organic substances, principally starch; then that of nitrogenous substances, collectively termed 'amides,' and of the function of chlorophyl, which is concisely stated to "absorb certain rays of light, and thus enables the protoplasm with which it is intimately connected to avail itself of the radiant energy of the sun's rays for the construction of organic substance from carbonic acid and water." A summary of what is now known of the metabolic processes is admirably stated on pp. 325–328; and an instructive table, showing the income and expenditure of matter and energy, is given. The energy is entirely referable to the absorption of light by the chlorophyl, and to heat.

Lecture XV. is devoted to the phenomena of growth; and the following six chapters, to irritability, which is thus minutely described, and the forces inducing its manifestation fully discussed. In the last two chapters the subject of reproduction is treated; and here may be found a *résumé* of present knowledge of the development of spores and seeds in the various divisions of the vegetable kingdom, the phenomena of hybridization, of parthenogenesis, and of variation. The closing sentence is, "Evolution is no longer a matter of chance, but is the inevitable outcome of a fundamental property of living matter."

At the close of each chapter of this most valuable book, copious references to the bibliography of the subjects treated are given; but, for some reason not apparent, these are only to the works cited, and, except in a few instances, not to pages. Had these been added, it would have greatly facilitated the work of students who desire to pursue the study further. A very extensive index, arranged not only by subjects, but also by authors quoted, is appended.

CHALLENGER REPORTS.

THE Challenger cephalopods were at first placed in the hands of Professor Huxley, whose numerous engagements finally obliged him to decline the work, with the exception of a special investigation into the genus Spirula. Mr. William Evans Hoyle, who was intrusted with the work by Mr. John Murray, has devoted the report now under consideration chiefly to systematic work, but expresses his intention of preparing a supplementary article on the anatomy of those specimens which are available for this purpose. He alludes to the fact, that, since the return of the Challenger, marine explorations have been so energetically prosecuted, that no less than five genera, new when obtained by the Challenger, have since been described from the collections of the U. S. steamers Blake and Albatross, etc. Mr. Hoyle has been favored with the assistance and friendly advice of Professor Steenstrup, and has compared with the specimens of the fine collection at Copenhagen all the critical Challenger species, thus insuring a double authenticity for the determinations of the report. The latter commences with an excellent synopsis of the species of recent cephalopods, with references to the places where they are figured and described. The Challenger collection contains seventy-two species of thirty genera. Of these, thirty-two species and four genera were new to science. For one of these, Amphitritus, possessing the unique feature of having the mantle fused with the siphon in the median line, so as to form two openings into the branchial cavity, a new family has seemed necessary. None of the giant squids were obtained; as, indeed, the means for capturing such animals in their native haunts have not yet been devised,

Report of the scientific results of the exploring voyage of the Challenger. Vol. xvi.: Zoölogy. London, *Government*, 1886. 4°.