which furnish the luminosity, clearly proves that the presence of a well-defined nervous system is not required for its manifestation, the protoplasm of their bodies alone sufficing for its development. There are no glands for secreting it, and, in some, apparently no fatty matter for slow combustion. In the coelenterates the phenomena appear to be more nearly related to nervous manifestations, though in certain cases the luminous matter possesses inherent properties of its own. While in certain annelids, again, such as Chaetopterus and Polycirrus, there are glands which may be charged with the secretion of a luminous substance, it is otherwise with certain Polynoidae, in which the emission of light appears to be an inherent property of the nervous system. The irritability in the phosphorescent examples of the latter family, however, varies considerably, some, e.g., Polynoe scolopendrina, being sluggish, while others, like Harmothoe, are extremely irritable. In the crustaceans the luminosity seems to have the nature of a secretion, probably under the control of the nervous system. In Pyrosoma and Pholas dactylus a luminous secretion is also a prominent feature; and in both the latter and the annelids, decay excites its appearance, as also is the case, to a limited extent, in fishes.

"It is evident, therefore, that the causation of phosphorescence is complex. In the one group of animals it is due to the production of a substance which can be left behind as a luminous trail. The ease, for instance, with which, in Pennatula and other coelenterates, the phosphorescence can be repeatedly produced by friction on a surface having a minute trace of the material, clearly points to other causes than nervous agency. The action, moreover, clearly affects the organic chemical affinities of the tissues engaged. On the other hand, again, as in certain annelids, it is purely a nervous action, probably resembling that which gives rise to heat."

Many of the older authors connected the emission of light with the economy of the deep sea: the same notion was brought forward in the 'Report of the cruise of the Porcupine,' 1870; and some naturalists still appear to hold a similar view. After stating the supposed benefits to be derived from the possession of this property by deep-sea forms, Professor McIntosh suggested that much caution is necessary in theorizing in this direction, explaining that, "In the first place, phosphorescent animals do not appear to be more abundant in the depths of the sea than between tide-marks, or on the surface, the latter, perhaps, presenting the maximum development of those exhibiting this phenomenon. Very many of the young that have been indicated as so brilliantly luminous become surface-forms soon after leaving the egg, and thus, at their several stages, more or less affect the three regions, — of surface, midwater, and bottom."

"A survey of the life-histories of the several phosphorescent groups affords at present no reliable data for the foundation of a theory as to the functions of luminosity." The irregularity of its occurrence in animals possessing the same structure and habits, the fact that the possessors of phosphorescence among annelids are often the inhabitants of tubes, or are commensalistic on star-fishes, in brief, the great variety of condition accompanying its presence in the different groups, necessitates the greatest caution in making deductions, especially if they are to have a wide application.

THE LEAVES OF THE PITCHER-PLANT.

THE *American naturalist* for June contains an interesting article by Joseph F. James, upon the evolution of the leaves of the pitcher-plant. He considers that the ancestral form belonged to the lily family, and that its home was South America, from which, in later times, it spread and modified itself in North America. He supposes that water, lodging on the upper surfaces of some leaves, was retained there; and that in this water insects were caught and drowned. Their decay might have produced a manure which assisted the plant in its growth; and the plant, finding it advantageous to have a cup-like leaf, would then, in a few generations, have developed just such a leaf as was needed. After a while, boggy land would be found better adapted for its existence, and the pitcher-plant family would be well started.

The primitive form is now lost; and the most rudimentary species is the Venezuelan genus, Heliamphora (fig. 1), which is simply a hollow tube, with a narrow opening one-fourth the way to the bottom, and with a small rudimentary hood at the top. Nearly the whole interior of the leaf is lined with hairs, those at the bottom long and slender, and those at the top short and thick. They do not seem to be either secreting or absorbing hairs, but serve simply to prevent the escape of insects. The next advance is in our Sarracenia purpurea, so common in the eastern and northern United States. In this species, there is a more perfect tube, open only at the top, and surmounted on one side by an upright hood (fig. 2), the inner surface of which is thickly covered with short,

FIG. 1.

FIG. 2.

stiff hairs, all pointing downward. The lower third of the interior is lined with slender bristles, the middle third is perfectly smooth, and the upper part is lined with hairs similar to those in the hood. But still the pitcher is open to the rain, secretes little or no honey, and absorbs the juices of the captured insects in the form of a liquid manure only.

Sarracenia flava shows a marked difference from the preceding, in that it secretes a nectar just below the hood. In Sarracenia variolaris (fig. 3), there is a wonderful advance. The hood bends over the orifice, thus shutting out the rain: it is marked on its posterior portion with white, translucent spots, and reticulations where honey is secreted; a secretion is formed at the bottom of the pitcher, which has the peculiar property of asphyxiating its victims: and a yet more striking advance is found to be a honey-baited pathway running from the ground up along the wing of the

FIG. 3.

FIG. 4.

leaf to the hood, and a short way into the orifice. A still further advance is found in Darlingtonia, a genus native to California. The hood forms a vaulted arch, mottled with spots and reticulations. The only entrance to the leaf is from below; and on each side of this entrance is a long appendage, the whole likened to a fish-tail (fig. 4). The inside of this secretes honey, and is covered with hairs. On the outside, running along the wing from the ground to the orifice, is a pathway of nectar which lures creeping insects to destruction, while the wings attract flying ones. A fluid secretion in the bottom of the cup has the power of decomposing the insects.

The flowers of these plants are also peculiarly modified for cross-fertilization; and the greatest amount of advance is found in the highest developed genus Darlingtonia, where the change has kept pace with the evolving leaves.

INSULAR FLORAS.

IT is a large quarto volume which we have before us, dealing with the botany of sundry small islands which were visited by the Challenger in her scientific cruise, made up of four reports, separately paged, and three indexes, and illustrated by sixty-five plates, which are consecutively numbered. With some arithmetical pains we ascertain that the letter-press occupies about 1,080 pages, counting in the leaves, one for each plate, upon which the figures are explained. A second volume is to contain the pelagic botany of the expedition. This one, under Mr. Hemsley's authorship, and devoted to the botany of the land and shores, concerns itself with the islands only, the continental collections of the cruise being too fragmentary, and of too well-known materials for any advantageous enumeration. Insular botany, however, has an interest of its own, — an interest quite independent of the size of the islands; for the botany even of small islands raises large and difficult questions. Moreover, their botany needs the most prompt attention; for it is everywhere undergoing rapid and irreparable deterioration and loss. At least four St. Helena plants once known to science have shared the fate of the dodo; several others are on the very eve of extinction; and no one knows how many have perished unknown and unconsecrated by scientific baptism. We are told in this volume that on St. Helena, —

"In 1709 trees still abounded, and one, the native ebony (Melhania melanoxylon), in such quantities that it was used to burn lime with. In 1745, however, the governor of the island reported to the court of directors of the East-India company that the timber was rapidly disappearing, and that the goats should be destroyed for the preservation of the ebony, and because the island was suffering from drought. He was instructed not to destroy the goats, as they were more valuable than ebony. Another century elapsed; and in 1810 another governor reports the total destruction of the great forests by the goats, which greedily devour the young plants, and kill the old by browsing on their leaves and bark; and that fuel was so scarce that the government paid for coal (and this in a tropical climate) £2,729 7s. 8d., annually. . . . About this time the goats were killed; but another enemy to the indigenous vegetation was at the same time introduced, which has now rendered it certainly impossible that the native plants [what are left of them] will ever again resume their sway. Major-Gen. Beatson proposed and carried out the introduction of exotic plants on a large scale."

The result of which is, that a foreign vegetation, chiefly European, Australian, and South African, of about sixty phenogamous species, and most of them worthless weeds, has taken the place of the native flora, nearly all of which was peculiar to the island, and which was known to have covered it with luxuriant forests down to the water's edge. The existing remnant of this peculiar flora lingers, rather than

Report of the scientific results of the voyage of H.M.S. Challenger, during the years 1873-76. Botany, vol. i. London, *Government*, 1885. 4°.