the verdict of those for whose use and guidance it has been compiled. The author of such a manual has many difficulties to encounter. He has to employ no little art and tact, so as to condense his material within reasonable limits. He has to avoid all unnecessary controversy, and, at the same time, he must endeavour to guard against any grave act of omission. The difficulties of the task are indeed so great, that it is not surprising that hitherto few of those which have been published have enjoyed the confidence of the profession. Dr. Aitken, to great natural talents, has brought the aid of an experience, which, commencing in the Royal Infirmary of Edinburgh, has been matured by his position as pathologist in the Glasgow Hospital, and more recently as attached, in the same capacity, to the army in the East. His extensive knowledge of medical literature, and his cultivated mental powers, have combined to form him a sagacious reasoner and a careful observer. The result is, that his Handbook is a model of arrangement, and may be relied upon as a safe and exact guide, full of comprehensive views, and of sound practical lessons.

We may be allowed to add, that his work is further deserving of praise, as being the first in which an attempt has been made to point out the value of an improved nosology, and to assign a prominent place to the subject of medical geography.

In concluding this notice, we earnestly recommend the "Handbook of the Science and Practice of Medicine" to the student, as the best guide in his studies, and to the practitioner, as the most complete and trustworthy manual in the English language.

II. *Introduction to Cryptogamic Botany.* By the Rev. M. J. BERKELEY, M.A., F.L.S.

WHEN Linnæus adopted the sexual organs as the basis of his classification of the vegetable kingdom, he left those plants in which no stamens or pistils had been discovered to constitute a class by themselves, under the happily-selected name of Cryptogams. This class, however, was in an altogether exceptional position. Distinct male and female organs had been found in every other vegetable species, and hence the just presumption that they existed, and would yet be detected, in the residuary class. The discovery, however, of the true character of the reproductive organs in cryptogams was impeded by two circumstances—the cultivating of the natural system by the French botanists, and the imperfection of the microscope, which was not adequate to the investigation of objects so minute as the reproductive organs of cryptogamic plants. In the natural system of Jussieu, the sexual organs were found incapable of affording characters, by means of

which classes and orders could be constituted. The nature of the fruit and the general structure of the plant were justly considered as of far higher importance. As usually happens in such cases, extreme views led to error, and the disciples of Jussieu not only neglected the study of the sexual organs, but they denied their existence in cryptogams, and bestowed on them the appellation of agamous, as if they were propagated by buds or bulbs. On the other hand, in Germany, where the natural system did not obtain so overpowering an influence, there were always botanists who continued to believe in the sexuality of the cryptogams, and to seek for the organs by which that function was performed. The imperfection of their optical instruments interposed difficulties not easily overcome, and there were almost as many opinions as observers. The monographers of the seventeenth and eighteenth centuries had carried such researches as far as the state of optical science could permit. They had thrown much light on the intimate structure of organized bodies. They had discovered the infusoriæ and spermatozoa, but only to raise questions which they could not solve, and at last these minute researches fell into disrepute, as being altogether unsatisfactory. Although unsuccessful in the great object of their search, there are several of them, such as Schmidel and Hedwing, whose works will ever be valued, and which deserve to be consulted even at the present day.

It is only within the last few years that the possession of improved instruments has enabled naturalists to throw a new light on the intimate structure and generation of plants and animals, and that the sexuality of the cryptogams has become an established doctrine. What is still more remarkable, now that the sexes of the cryptogams are known, is the important fact that many of them, in their modes of propagation, approach far nearer to the animal kingdom than the phænogams or flowering plants. The spermatozoids of the cryptogams present a far closer resemblance to spermatozoa than does the fovilla of the pollen tube; the conjunction of the spores and spermatozoids of fuci has no analogy in the vegetable kingdom, and its nearest affinity is with the fertilization of the ova of frogs and fishes. In another respect the cryptogams approach to the animal kingdom, by exhibiting in some cases the remarkable phenomenon of alternate generations; and in this respect the generation of ferns resembles that of a medusa. We thus find that the affinities of the animal and vegetable kingdoms are not to be sought for in their most highly organized representatives, but in their lowest orders, where both structure and function have been reduced to their simplest expression. It is this consideration which gives the study of cryptogamic botany special claims on the attention of the physiologist and student of medicine; and it is on these bodies that he can commence the study of histology, or the early stages of the reproductive process, with the greatest facility. "If," says

Mr. Berkeley, "he wishes to ascertain the mode of growth in cells, he will be able to trace, step by step, the division of the primitive cell, in consequence of the great transparency of the walls; and in the *confervæ* he can assist at the origination of new cells, not merely by subdivision, but the formation of new cells by pullulation from the walls. He can observe spermatozoids developed with perfect freedom in mother cells, and not mere appendages separated from their walls; and such investigations will come in aid of these relative to the development of spermatozoa in animals. Again, if the question be whether cellular structure can arise without the presence of a previous mother cell, he will find in fungi that the productive bodies are generated from the endochrome of the fructifying cells. In this case, he can watch the development of the spores from the moment the endochrome commences to be organized, and can with confidence assert that they are not the creatures of pre-existing cells, but the produce of the endochrome itself. In other cases he will observe phenomena scarcely known in the animal kingdom; as when two cells of separate plants approach each other, and the contents of one of them is received into the cavity of the other, and from the mingling of the endochromes a multitude of zoospores or fertile seeds are produced. In the case of mushrooms, he will find that the individual plant is produced, not from a single spore, but from the confluent vegetation of many."

Cryptogams differ from phænogams in many respects. Not to speak of the very general absence of all vascular tissue, it is a universal character, that none of them possess pollen globules, nor anything analogous to the fovilla of the pollen tubes; and as to the female organs, in none of them is there anything resembling the embryo of the higher orders. Their seeds, called spores, are merely cells, which are fertilized, not by pollen, but by spermatozoids, which are often active, and move by means of ciliary organs, and more analogous to the spermatozoa of animals than to vegetable pollen grains. According to Mr. Berkeley, the cryptogams may be arranged under two divisions:—The Thallogens, which are seldom herbaceous, or furnished with leaves or stomata, and the spermatozoids are not spiral; the second division, or Acrogens, are foliaceous, and have spiral spermatozoids. A most important distinction between the two divisions consists in the origin and mode of germination of the spores. In the Thallogens, viz., algæ, lichens, and fungi, the process of development and reproduction is more simple and easily understood. If we select as an example the fuci or sea-weeds (properly so called), we find that the organs of reproduction may be either monœcious or dioecious. In the one set of organs there are spores or germs, and in the other cells, containing spermatozoids, which are active, moving bodies, furnished with flagelliform appendages. The cells of both kinds at length burst, and the spores and spermatozoids swarm

together, and fertilization takes place out of the body of the parent plant, resembling what takes place in the fertilization of the salmon or other fishes. The spores then attach themselves to some foreign body, and vegetate into sea-weeds. In this case the course of reproduction is easy to follow; but in the case of the acrogens the process becomes much more complicated. In the mosses, ferns, and equisetaceæ, the generative cycle becomes more complicated. In mosses, the spore or germ vegetates, and forms a number of filaments, which give rise to two kinds of cells, respectively containing spores and spermatozoids; and after fecundation, the germ is elevated, and expands into a capsule, containing spores, which are produced without the aid of male organs. In this case there are both analogies and differences, when compared with what takes place in a phænogamous plant. The spore, by its vegetation, does not produce a moss, but a mass of filaments, and on them the male and female organs are produced; and from the germ thus formed, the moss and its capsules are evolved, in which we find fertile spores, which have no sexual origin. Thus in the case of mosses, the stages of development are more numerous than in the case of an annual flowering plant. In the first stage, in the moss, we depart from a spore, produced without the aid of male organs; and consequently, not a seed or embryo, but a gemma or bud. The spore produces a number of branching threads, furnished with male and female organs, and this is the plant in its perfect state. From this filamentous plant, an ovum or seed is produced, which grows into what we usually call a moss, terminating in capsules, containing spores or buds, but not seeds. In ferns, the mode of reproduction is still more remarkable, and may be easily explained. On the frond or leaf, as it is popularly called, of the fern and on its dorsal aspect, are produced numerous capsules, containing spores or buds. The vegetation of these spores produces a membranous expansion, which may be considered as the perfect plant, since it bears on its under surface both germ-cells, and cells containing spermatozoids entering the germ-cell, which, thus fertilized, gives origin to the new plant, or to what we usually call a fern, producing spore seeds, as already stated.

In the higher cryptogams, as the ferns and others, we have, therefore, examples of alternate generations, similar in many, but not in all respects, to those which we observe in the animal kingdom. In the fern, the prothallus, with its male and female organs, does not produce another thallus, but a sporiferous frond; and again, the prothallus is produced from the frond. This alternation is analogous to that which takes place in the molluscs, called Salpæ, where solitary salpæ give birth to individuals of a different form, which are united together in long chains; and each of these concatenated individuals gives birth, again, to solitary salpæ. In the ferns there are some circumstances still more remarkable.

The little membranous prothallus, with its complete reproductive apparatus, perishes, after giving birth to a fern plant, which may be a tree-fern, emulating the palms in stature, and producing, throughout a century, millions of spores, without the aid of any spermatic influence. In this case, therefore, the influence of the spermatozoid, which penetrated the germ-cell of the prothallus, by a wonderful potentiality, may extend its influence to thousands of spores, annually produced on the fronds, and throughout a long series of years. Something very similar to this is now known to be not unfrequent among insects, where successive generations of females propagate the species without access to the males; and in this case also, the progeny of a single female may amount to hundreds of thousands. The cases, however, differ in this respect, that, in the case of the insects, the whole of these prolific females perish at the end of autumn, while, in the ferns, the process may continue throughout a century. Of the causes of these phenomena we know nothing, and Mr. Owen's attempt is, we think, rather a description of what has been observed, than an explanation how it was produced. According to Mr. Owen, the primary impregnated germ-cell propagates a numerous progeny by the segmentation of the vitellus. Part of these cells contribute to the formation of the individual, while there is a superfluous number diffused through the body, which multiply indefinitely, and, under proper conditions, can give origin to new individuals, without any new spermatic influence. Thus, in the case of the fern, the derivative germ-cells multiply by myriads each year on the back of the fronds, and each of these spores contains the rudiments of a future fern. If this be the case, we may inquire what is the necessity for fecundation at all. It is true that a single act must have taken place after the first creation of the species, but the subdivision of the germ-cells would have sufficed for all future time. It amounts merely to this, that all organic bodies arise from a cell or cells, and that each species has its own determinate and inseparable attributes.

If we cannot give a theory of the intimate nature of the changes which constitute alternating generations, we can at least compare the phenomena as they occur in the various classes of the animal and vegetable kingdoms. The point of departure should be taken from the individual when in the full development of its generative faculties, by means of organs producing germs and spermatozoa or spermatozoids; and in this case, the sexes may either be separate or on different individuals. It is also to be remembered that the perfect development of the genital organs is not always equivalent to that of the plant or animal. Thus, in the *Lernæa cyprinacea*, the young animal is an active crustacean, furnished with feet and eyes; while the mature female is merely a worm, with an attached mass of ova. In this case, the foetus *in ovo* is a far more highly organized creature than the mother, when she

gives it birth. It is the same with the mushroom and the fern. In the former, the plant is a filamentous moss, called the mycelium; while what we see above ground is merely the reproductive part of the plant; and in the latter, the membranous prothallus, with its germ-cells and spermatozoids, resembles a marchantia or a lichen, and is far inferior in dignity to the frond which it originates.

The first stage in the progress of alternation is therefore always a product of sexual generation—a germ ovule or ovum, as the case may be. In this respect the prothallus of the fern is equivalent to a pair of perfect insects of the genus *Aphis*, only the prothallus is monœcious, and the insect dioecious; and the one produces a fertilized spore or ovule, and the other an ovum. The germ of the fern produces a frond, and the ova of the *aphis* produce wingless larvæ; and the only difference is that the prothallus gives birth only to a plant, while the pair of aphides produce many ova. The difference, however, is unimportant; for in perennial mosses the prothallus gives birth to several crops of germs, and each leaflet of the fern frond may be viewed as an individual plant. The larvæ of the aphides are all female; and these generate other females for more than seven generations without the aid of males, and they are therefore the analogues of the frond in the fern. In this case each generation of larvæ in the *aphis* is equivalent to an annual reproduction of the frond in the fern. The frond perishes annually; a generation of larvæ, in a few weeks. The larvæ breed, as Steerstrup has remarked, by a process of gemmation, which are alternate. In the first a germ is formed by the aid of the male organs; the second is agamous, and is a process of gemmation. In this respect we do not think the term parthenogenesis, employed by Mr. Owen, happily chosen, even upon his own theory; as all the individuals produced are, even on his own showing, derived from the subdivision of cells, fertilized by spermatic influence. It is also to be remembered that, in increase by gemmation, the individual which produces the gemmæ is in many cases truly agamous, that is, neither male nor female. No one would call the stem of the *Lilium tigrinum* or the leaf of the *malaxis* females, although they propagate gemmæ. The frond, in like manner, produces spore gems. At last, the spore of the fern again gives rise to a prothallus, and the gemmation of the larvae terminate in the production of perfect males and females.

From these observations, it will be seen how important the study of cryptogams is to the physiologist, and the value of an introduction to their study, such as Mr. Berkeley has furnished. It possesses the high character of being something far superior to a mere compilation, being the work of an original observer, who has devoted a lifetime to the study. In Mr. Berkeley we have not merely the careful observer, but what is far more rare, the independent thinker, who has produced an invaluable text-book for the student.

The best book is not without its faults; and we think a clearer exposition of his matter, and a more luminous disposition of his materials, would have greatly enhanced the value of the work. The author has not been employed as a teacher of the science, and sometimes forgets he is writing for beginners, and discusses his subject as if addressing those who are already its masters. Another great deficiency is the omission of an adequate glossary of the scientific terms. Indeed, the confused terminology presents a serious obstacle to the study of a science already sufficiently difficult. Sometimes the same organ has a multiplicity of names; sometimes the same name is applied to different objects—thus perplexing us with the opposite evils of redundance and poverty. This omission is, however, but a slight evil when so fully compensated by the numerous excellencies of the work.

III. *On Stricture of the Urethra.* By HENRY SMITH, F.R.C.S.
1857.

WE had thought, after the controversies of the last few years, we were, as reviewers, to have done, for a season at least, with the subject of stricture of the urethra. We were under the impression that the nature of the affection, as well as its modes of management, had been explained with sufficient precision and correctness in our best text-books, as well as in not a few monographs, as to leave little or nothing to be desired in the way of exposition or confirmation of facts and theories, or in the way of improvement on well-known methods of treatment. In this, however, we have been mistaken. The tilting of two northern professors; the logomachy of our chief medical societies; the pleadings of several notorious specialists—legitimate and illegitimate; and the condensed eclecticism of some systematic writers, in addition to the impartial, comprehensive, and elaborate summaries of prize-aspiring essayists—have not, it seems, been sufficient for that portion of her Majesty's subjects who practise the art of surgery. In our simplicity, we had almost forgotten that this is an age of book-making, and that medical men now-a-days are not, as formerly, content with their lucubrations appearing in the columns of our ordinary periodicals, till they had amassed a sufficient number of facts corroborative of their peculiar views, before presenting themselves singly and ostentatiously to the public. We think, nevertheless, that writers would honour the modern custom more in the breach than in the observance; particularly in cases wherein they have to tread chiefly in paths already indicated and gone over by those who may be said to be masters of the ground.