ART. XII.

A Practical Treatise on the Use of the Microscope, including the different Methods of preparing and examining Animal, Vegetable, and Mineral Structures. By JOHN QUEKETT, Assistant Conservator of the Museum, and Demonstrator of Minute Anatomy at the Royal College of Surgeons of England. Illustrated with Nine Plates and Two Hundred and Forty-one Wood-engravings.—London, 1848. 8vo, pp. 464.

WE know of no subject on which a good book was more needed, than on the Use of the Microscope; and we could not name any individual more competent than Mr. Quekett to write one upon it. Early disciplined in its use, devoted to its employment as a favorite object of pursuit, enjoying, from his position at the College of Surgeons, the most extensive opportunities for carrying forward the class of investigations in which its value as an instrument of research has now been abundantly tested, in continual communication with almost every one of the principal microscopists of this kingdom, and himself distinguished not merely by his acquaintance with what has been accomplished by others, but by the zeal and success with which he has followed out various branches of original inquiry, Mr. Quekett unites all the qualifications, save practice as an author, which could give a value to his production. Our strong desire to see our young microscopists furnished with a faithful guide, under whose direction they might make their instruments really do good service to science, instead of allowing them to lie comparatively useless in their cases,—coupled with the anticipations which our personal knowledge of Mr. Quekett led us to form,—caused us to look forward to the long-delayed appearance of this work with no common interest; and it gives us great pleasure to be able to say with sincerity, that our expectations have been in the main fully realized. We do not mean to say that the book is incapable of improvement; there are no human productions which are not; but after having carefully perused it, and carefully tested it by our own experience (which, if less extended, has been at least as long as our author's), we can most conscientiously and cordially recommend it to all such of our readers as, already possessing microscopes, desire to know how to bring them into most advantageous use, and to such as are only deterred from acquiring the instrument by the want of knowledge how to use it.

We shall not attempt to make an analysis of this book; for the simple reason that no analysis could be of any use to our readers; and our notice of it will be entirely confined to an enumeration of its principal contents, and to an indication of the points on which we think there is most room for improvement. After what we have already said, we feel sure that neither Mr. Quekett nor our readers will accuse us of a captious spirit in specifying these; did we entirely pass them by, we might be charged by some of the latter,—who will undoubtedly be acute enough to discover, in making themselves acquainted with the book, that it is not perfectly faultless,—with having given it too unqualified a recommendation.

The work is divided into three parts: the first treating of the *mechanical arrangements* of the microscope; the second, of the use of the *microscope and its appendages*; and the third, of *manipulation*, including the methods of preparing and mounting objects.

As an Introduction to the first part, we have a chapter on the history of the microscope, without which the book would certainly have been incomplete. We think, however, that the history might have been somewhat more restricted to the progress which the instrument has made, in the hands of its various improvers, towards its present perfection; and that in the place of some of the descriptions and figures of the earlier forms, which are of little value save to those who have a taste for antiquities, it would have been interesting to have had a fuller account of the labours of some of those early microscopists,—Hooke, Leeuwenhoek, Malpighi, and others,—who so remarkably made up by their industry and penetration for the imperfection of their instruments, and made such near approaches on many points to the discoveries of modern times. We have no such fault to find with the later portion of this introduction, in which the history of recent improvements is detailed; since we deem it but right that every important step in that truly wonderful advance, by which, in little more than twenty years, the microscope has been metamorphosed from a scientific toy into an instrument second to none in its capacity for the revelation of the hidden operations of Nature, should be attributed to its real originator. Here we think that our author might have been a little fuller with advantage, and have given us somewhat more information respecting the labours of foreign opticians, especially those of Germany, who have received scarcely any mention. We happen to know, from a careful comparison of instruments, that about ten years ago, the achromatic combinations of Schiek of Berlin, and of Ploëssl of Vienna, were decidedly superior, in many points, to those of our best London makers; and though we believe that the latter are now decidedly the first in the world, it would have been as well to state in what their superiority consists, in order to prevent even the appearance of that exclusive spirit of which we frequently complain in our continental neighbours. They would seem to be very closely pressed, of late, by a young American backwoodsman, of the name of Spencer; an achromatic object-glass of whose construction is stated to have detected three sets of lines upon a species of *navicula*, which other glasses of equal power, made by the first English opticians, entirely failed to define. The latter, we suspect, must either have been constructed some few years back, before they had arrived at the present perfection, or they could not have received a fair trial; for the identical specimen of the *Navicula Spencerii* which they failed to resolve, having been sent to this country, the lines described by Mr. Spencer could be clearly seen, and (what is a sufficient test of the superiority of the British lenses) could be resolved into a series of minute dots. That so near an approach could be made, however, to our boasted superiority, by a self-taught artist, living out of the sphere of that emulation which has been so fertile in improvements among the opticians of England, France, Germany, and Italy, indicates an extraordinary amount of ability on his part, from which we may expect yet greater results.

We notice in Mr. Quekett's writings, as in those of many other authors, a want of proper discrimination between the terms *invention* and *discovery*. Thus we are told (p. 9) that Newton *discovered* the compound reflecting microscope, and again (p. 14) that we owe to Lieberkuhn the *discovery* of the solar microscope. Yet in the very next sentence, we

have "the solar microscope, as *invented* by Lieberkuhn." Here, then, these terms are used synonymously. But that they are not really synonymous, must be apparent to every one on a little consideration; for who would speak of the *invention* of the circulation of the blood? We apprehend that the term *discovery* is only applicable in cases where something which previously existed, but which had remained unknown, has been brought to light; thus, that the parenchyma of the liver is made up of cells, is an important discovery. On the other hand, we employ the term *invention* in cases in which the product emanates from the mind of the inventor; thus we speak of the invention of the steam-engine, of the telescope, microscope, &c., which have not resulted from observation, but from a constructive effort of mind.—This, however, is a minor blemish, which we should not stop to correct in Mr. Quekett's book, if the error were not so frequently committed by others.

The First Chapter treats of the *Simple Microscope*, of the *Doublets and Triplets* which are used in the manner of simple lenses, and of the various forms of *Dissecting Microscope*. The last of these three heads is the one on which our author most profitably dwells; since single microscopes will never be used again by scientific men, save as mere magnifying glasses for examining the general characters of objects with low powers. The doublets and triplets were vast improvements in their time; but no one who can avail himself of an achromatic compound microscope, will ever employ them in preference. A great variety of forms of dissecting microscopes are described and figured; and the reader is rather likely to be disturbed by the *embarras des richesses*, in the absence of any very definite indication afforded by Mr. Quekett's own experience as to, which he should prefer. For ourselves, if a single or doublet microscope be alone required, we do not hesitate to avow our preference for that invented by Mr. Slack (p. 57). Where it is desired, however, to add a compound body to the same apparatus, the instrument of Messrs. Powell and Lealand (p. 52) will be found extremely advantageous, especially if furnished with the erecting eye-piece and draw-tube, by means of which a great variety of power may be attained.

In Chapter II, Mr. Quekett passes on to the *Compound Microscope*; and here, after a general account of the essential components of all forms of the instrument, he describes and figures, with most laudable impartiality, no fewer than nine different forms of microscopes, constructed by London makers, namely, three by Messrs. Powell and Lealand, two by Mr. Ross, and four by Messrs. Smith and Beck. Here, again, those not in possession of any previous information on the matter will be perplexed in their choice, by the want of some statement of the relative advantages of these different forms; and we cannot but think that, from a practical microscopist, who has had opportunities of using them all, some such indication might be fairly expected, without justly giving occasion to any suspicion of favoritism or unfairness. In fact, all parties are now so well agreed upon certain general principles, that the differences are only in details; and we think it would have been preferable to have selected a single instrument of each maker, which might have been regarded as the type of a class, its special merits being elucidated, and the chief variations in construction by the several makers briefly explained. Thus we are our-

selves satisfied that, for simplicity and cheapness, combined with sterling excellence of workmanship, nothing that is made comes near to the larger of Messrs. Smith and Beck's "Student's Microscopes" (fig. 1, plate 4), in which the peculiar excellence of their plan of construction—the mode in which the body is supported and moved—is as well seen as in their larger and more costly instruments. So, again, we believe that Mr. Ross may say with truth that his large microscope (plate 1) is equally complete and perfect in its way, and may be fairly taken as the type of a costly instrument furnished with all desirable appliances. The mode of supporting the body adopted by Mr. Ross has this advantage over that of Messrs. Smith and Beck, which is in other respects preferable—that the body can be turned completely away from the stage, which, for certain purposes, is very convenient. And of the productions of Messrs. Powell and Lealand, their portable microscope (p. 80) would, perhaps, be a very fair sample. By a little abridgment and discrimination in these particulars, Mr. Quekett would have found room for an account of some of the Parisian and German microscopes, most of which are constructed on a plan very different from those of London makers; and this would have been the more useful, as many students and medical travellers purchase microscopes abroad, under the idea that they are better as well as cheaper than those of London makers,—from which it would have been well to undeceive them. Considering, too, that the vast amount of microscopic information which has emanated from the Continent, bespeaks acquaintance on the part of the makers of these instruments as to what is practically valuable, we should have liked to find our own knowledge extended by a few examples of the varieties in microscopic construction, which have found favour with our industrious brethren of Germany and France. The only one of which we find any account is the dissecting microscope of Oberhauser, described in a later part of the volume (p. 326). Some such addition might very well replace the account and figure of the cumbrous and imperfect microscope of Mr. Varley (p. 95), which no one, we think, save the inventor, would find any comfort in using.

In the next chapter we have an account of the various *accessory instruments* which may be adapted to the microscope for various purposes. This we shall pass by with little remark, as it contains nothing redundant or superfluous, and presents no deficiency. Although there is scarcely anything in it with which practised microscopists are not likely to be acquainted, yet it must be remembered that the book is not written for them, but for learners. As a novelty emanating from Mr. Quekett himself, we may specially mention the "indicator," which will be found very useful in class demonstrations. Chapter IV, on that important accessory, the lamp, gives very explicit directions for obtaining a satisfactory light; on these, however, we need not dwell. With Chapter V, on the *magnifying powers of the microscope*, the first part of the work concludes. In this chapter we notice some repetition of the latter part of the introductory history, which should have been avoided. If the history were complete, nothing would be here required but a description of the optical action of the lenses, as now constructed by all the best makers. Here, as in his history, Mr. Quekett pays a just tribute to Mr. Lister, to whose combination of practical and theoretical knowledge we owe the develop-

ment of powers in achromatic object-glasses, which it had not been previously imagined that they could attain.

In Part II, the *use of the microscope* is described, under the following heads:—Chap. I. Preliminary Directions. Chap. II. Illumination of Objects. Chap. III. Micrometer. Chap. IV. Determination of the Magnifying Power. Chap. V. Camera Lucida. Chap. VI. Polarization of Light. Chap. VII. Goniometer. All these subjects are very fully and clearly discussed. We should have liked an additional chapter, containing hints to young microscopists as to the interpretation of the appearances which they witness, and the sources of fallacy to which they are liable. Mr. Quekett's large experience as a microscopic demonstrator must have given him ample materials for such an exposition, which would have constituted, we think, one of the most valuable chapters in the whole treatise.

Those who are already in possession of microscopes, and who understand the method of using them, will probably turn to the Third Part with the greatest anticipation of benefit; and we do not think that they will, on the whole, be disappointed, although there are some omissions which we cannot but regret. The first two Chapters, on the *Diamond*, and on *Cutting Glass*, need not detain us. The Third treats of the methods of *Cementing Cells*; the Fourth, of the method of *Mounting Objects in Fluid*; the Fifth, of *Cements*; the Sixth, of *Preservative Fluids*; the Seventh, of mounting objects in *Canada Balsam*; the Eighth, of mounting objects in the *Dry Way*; and the Ninth, of mounting *Opaque Objects*. On all these matters, the author's large experience enables him to give a complete account, from his own personal trials, of all the most valuable methods that have been proposed; and the only fault we have to find with this portion of the book is, that he does not always clearly indicate which of these methods he himself prefers, or why he does so, which is exactly what his readers most want to know. Many very useful and ingenious methods of manipulation, which are but little known, save to those who are in intercourse with their several inventors, are described in this part of the work.—Having thus given directions for mounting objects when we have got them, Mr. Quekett proceeds to enlighten us as to where and how we are to “catch our hare,” or, in other words, to instruct us in the arts of collecting and preparing objects. We have not been able to discover any particular order in the succession of subjects; and shall enumerate the heads of the chapters as they successively present themselves. Chap. X gives directions for making sections of *Bones and Teeth*; and Chap. XI for making sections of *Shell* and other *Hard Tissues*. As the hard tissues here referred to are of vegetable growth, it would have been surely more natural to have classed “shell” with “bones and teeth,” in the preceding chapter; since it so closely resembles those substances, and the manner of preparing it is the same. The second of these two chapters would then have been left clear for the vegetable tissues, if it was thought requisite to make them form a distinct division. In Chap. XII we are instructed how to make *Sections of Wood* and of animal substances that can be treated in like manner. In Chap. XIII, we have general directions for the dissection and preparation of the *Softer Vegetable and Animal Structures*; with

representations and descriptions of all the most useful instruments ; and in Chap. XIV we find more specific directions in regard to the method of preparing particular textures, especially the *Nervous* and *Muscular*. The best methods of exhibiting the *Circulation of the Blood* are described in Chap. XV ; and the *Circulation in Plants*, together with the mode of cultivating *Chara*, *Vallisneria*, &c., are treated of in Chap. XVI. In Chap. XVII are detailed the best methods of procuring *Infusory and other Animalcules* ; the localities of the most interesting kinds found in the neighbourhood of London are pointed out ; and directions are also given for mounting *Fossil Infusoria*. Chap. XVIII is the longest, and one of the most important in the whole volume ; being devoted to a general account of the principal classes of microscopic objects, arranged in the first place under the heads of animal and vegetable, and then under various other minor divisions. Not only are the general sources indicated, from which objects of interest may be obtained, but lists are given of the specific forms which are most worthy of attention. The chapter also embodies a concise account of the principal forms of animal and vegetable tissue ; which, coming from one so familiar with their characters, possesses considerable value. We are somewhat disappointed, however, at finding some matters omitted, or very scantily treated, as to which we had quite calculated on meeting with full information ; such, for example, as the mode of making minute injections ; and the whole chapter might be considerably improved in regard to the arrangement of its materials.

The next chapter, entitled *Methods of Examining Morbid Structures*, consists of only two pages ; and we are constrained to say that the tyro in microscopy will find the directions contained in it by no means sufficient for his guidance. Perhaps Mr. Quekett has here put a restraint upon himself, from the consideration that his book is not intended for medical men exclusively ; but he might have bethought himself that at least two thirds of his readers will be medical men, and that as he has fully treated polarization and other matters in which the interest is by no means universal, a subject so important to a very large proportion of microscopists should scarcely have been passed by with so little notice. We may notice, among other omissions, that we find no mention whatever of urinary deposits ; for the examination of which the microscope is, or ought to be, more used by medical practitioners, than for any other single purpose. Chapter XX treats of test objects, and is illustrated by a series of extremely beautiful figures, drawn by Leonard, and engraved by Sowerby. Under this head is described a new test, first brought to this country (we believe) by Professor J. H. Bennett, which is remarkable for being an *artificial* production. It consists of a series of bands of lines etched on glass by M. Nobert ; the lines on each band being at a certain definite distance from one another. In the first band, the distance of these lines from each other is $\frac{1}{1000}$ th part of a Prussian line ; in the tenth band, the distance is no more than $\frac{1}{4000}$ th of the same quantity, or $\frac{1}{46008}$ th part of an English inch ; in the intermediate bands, the distance of the lines is gradually diminished in a geometric ratio. It has been regarded in this country as a wonderful performance to rule 10,000 lines to the inch ; but our artists must acknowledge themselves beaten by M. Nobert, whose lines, when more than $4\frac{1}{2}$ times as numerous,

are as clear as those at a greater distance. This seems to be the best test of the separating or resolving powers of object-glasses that has yet been devised. Thus a $\frac{1}{4}$ th inch glass of the best quality, and under the most favorable circumstances, will show nine of the bands, and will resolve the lines in seven of them; but no trace of the tenth can be seen. A good $\frac{1}{8}$ th will define the lines in eight or nine of the bands, and will show the tenth; whilst, to define the lines in these last, a very good $\frac{1}{12}$ th is required.—The last chapter contains some useful miscellaneous hints on the management of the microscope, and the conservation of microscopic preparations.

In bringing our notice of Mr. Quekett's work to a conclusion, we would remark that, although we have freely commented upon what we deem its redundancies and defects, we have nothing to say in disparagement of its accuracy in regard to the great variety of subjects on which it treats; and we can cordially recommend it, therefore, as a safe and valuable guide to Microscopists of all degrees of advancement, with the full assurance that there is not one among the most practised who will not derive from it some useful hints, whilst to the beginner it will prove of most important assistance. We must not omit to mention, that in the profuseness and excellence of its illustrations, it fully sustains the character of the Series of Standard Scientific Works of which it forms a part.

ART. XIII.

1. *Hints towards the Formation of a more Comprehensive Theory of Life.* By S. T. COLERIDGE. Edited by SETH WATSON, M.D. Oxon.—London, 1848. Post 8vo, pp. 94.
2. *Reflections on Organization; or Suggestions for the Construction of an Organic Atomic Theory.* By HENRY FREKE, A.B. M.B. T.C.D., M.R.I.A.—Dublin, 1848. 8vo, pp. 80.

THE question of the abstract nature of Life has, by common consent, lain in abeyance for some time. It has been felt that the new views opened up by microscopical and chemical research needed to be matured and digested,—the true relations of vital and physical phenomena to be more precisely determined,—and the share which the properties of inorganic matter have in the functional operations of the living organism to be more clearly discriminated,—before the metaphysics of physiology could again be profitably pursued. Yet it has seemed more and more obvious, in what direction speculation would tend. Physical philosophers have been gradually abandoning the idea of electricity, magnetism, affinity, &c., as *entities* distinct from matter; adopting the far more simple and logical method of viewing them as properties of the matter through whose intermediation they are exhibited. At the same time, they have been pushing their inquiries into the penetralia of the organized body; and have shown that, so far from there being nothing in common between the phenomena of life and the physical and chemical actions of inorganic matter, a large proportion of the former may be brought under the same category with the latter, being due to the operation of the very same properties under different conditions. But the physiologists, on their side, have not been