5. *Microgeology of Ehrenberg.*—A continuation of Ehrenberg's great work has been recently issued, consisting of 88 pages large folio; and it relates exclusively to North America. It consists of descriptions of earths and river sediments, from the different states of the country, as regards their infusorial contents, and tables of the results for each. The parcels examined and here described amount to 247, 85 of which are from Texas, 4 from Arkansas, 36 from the Washita and Neosho, etc. The number of microscopic species observed by Ehrenberg and Bailey in the Southern United States is 855; of these 148 are brackish water and marine species, about half of them being fossil and half living.

6. *Note on New Fossils in the Potsdam Sandstone at Keeseville, New York;* by J. D. DANA.—Hitherto the Potsdam Sandstone of New York, the lowest rock of the Silurian, has been known to afford no fossils but one or two species of the genus Lingula. Through the researches of a young and energetic student in geology, of New Haven, Mr. Frank H. Bradley, who visited Keeseville last summer and has recently been again at the locality, a species of Trilobite (genus *Calymene*) has been discovered, and also one of *Pleurotomaria*, besides an impression of a crinoidal disk. The Pleurotomaria is only a cast. The Trilobite, although a small one, its breadth but one-eighth of an inch, is well preserved. The buckler and caudal extremity have not been found together, but the markings of each are very distinct.—*Proceedings Montreal Meeting Amer. Assoc.*

III. BOTANY AND ZOOLOGY.

1. *An Elementary Course of Botany; Structural, Physiological, and Systematic; with a brief Outline of the Geographical and Geological Distribution of Plants.* By ARTHUR HENFREY, F.R.S., L.S., &c., Professor of Botany in King's College, London, etc. 1857, pp. 702, small 12mo. London, Van Voorst.—This is a well-planned, compact, and comprehensive work, in which we may say, that the author has fairly accomplished his purpose, namely:—"to produce a good working text-book for the student, from which may be obtained a groundwork of knowledge in all branches of the science, without the attention being diverted from the more striking features of the subject by details comparatively unimportant."

The work is divided into four parts: I. Morphology or Comparative Anatomy, treating, in successive chapters, 1st. of General Morphology; 2nd, of the Morphology of the Phanerogamia, or the parts of Flowering plants and their modifications, and the laws which regulate them; 3d, Morphology of the Cryptogamia. Part II. Systematic Botany; treating 1st, of the principles of Classification; 2nd, of systems of Classification, and 3d, systematic descriptions of the Natural Orders, followed by an artificial analysis. Part III. Physiology; comprising, 1st, the physiological anatomy of plants; 2d, general considerations on the physiology of plants; 3d, physiology of vegetation; 4th, the reproduction of plants; 5th, Miscellaneous phenomena, under which are ranked the evolution of heat in plants, luminosity, and movements of plants. Part IV. Geographical and Geological Botany, very summarily disposed of in about forty pages.

It seems strange at first to interpose Systematic Botany between the morphological and the physiological; but if the anatomy and physiology of plants are to be completely disjoined from the study of the organs of the plant as a whole, the present arrangement is perhaps as good as any. It is adopted, as the preface shows, for the convenience of instructing medical students, who compose the principal part of classes in Great Britain as well as on the Continent;—for whom "one short course of lectures is devoted to this science, and three months is commonly all the time allotted to the teacher for laying the foundations and building the superstructure of a knowledge of botany in the minds of his pupils, very few of whom come prepared even with the most rudimentary acquaintance with the science." But the author remarks that "if the previous education of medical students prepared them, as it should, with an elementary knowledge of the natural sciences, we should make physiology the most conspicuous feature of a course of botany in a medical school."

While in England botany is scarcely an academical study, here it pertains to collegiate and academical instruction where it is taught at all. In Europe not even an apothecary can be licensed without passing an examination in botany; in the whole United States, we believe, it forms no part, at least no regular part, of the medical curriculum; no medical school has a botanical chair; and no knowledge whatever of the science of the vegetable kingdom, which supplies the greater part of the *materia medica*, is required for the degree of Doctor in Medicine!

Professor Henfrey is chiefly known, and most highly esteemed, as a vegetable anatomist. Upon this subject he may speak with an authority which, as a systematist, or even as a morphologist, he would not pretend to. We shall offer no apology, therefore, for making an occasional criticism, and for pointing out several errors in matters of detail. These are not intended to disparage the work, for if we had not formed a high opinion of it on the whole, we should not take this trouble.

As respects the first point noticed, our author, if wrong, is not alone. Still, we hardly expected him to teach that the radicle of the embryo is the true root; and we cannot let pass unchallenged his reiterated statement that in Monocotyledons, the radicle, or its inferior extremity, is never developed into a root in germination, but is abortive (pp. 14, 16, 18, 391, 537). Any one who will examine the germination of the seed of an Iris, an Onion, or even of a grain of Indian corn, cannot fail to perceive that a primary root is developed, and that this is a direct prolongation of the extremity of the radicle. This, indeed, does not continue as a tap-root; neither does it in a great many Dicotyledons. In squashes, pumpkins, &c., there is no one primary root, but a cluster of rootlets from the first, all springing from the base of the stout radicle. In fact, this distinction between Monocotyledons and Dicotyledons is null. A character of certain monocotyledonous embryos, neither strictly peculiar to the class, nor by any means universal in it, should not be assumed as distinctive. As to the morphology of the radicle *itself*, we suppose that the germination of any of the larger Cucurbitaceæ, or of a bean, would suffice to convince any observer that the radicle is simply the first internode of the stem, giving birth to the primary root from its inferior extremity, usually,—and indeed, from the exceptional cases where it does not we should draw addi-

tional proof of its cauline nature. In fact, we know of no character in which a root differs from an internode of a stem in which it does not also differ from the radicle, excepting its tendency to direct its inferior extremity downwards. Again, should the statement, that "the radicle of a monocotyledonous embryo is never developed" be held to mean that the radicle never lengthens, we remark, no more does it in the pea and some other hypogæous Dicotyledons; and we are not quite sure that the statement is absolutely true of all Monocotyledons.

Root-hairs or *fibrillæ* are mentioned (p. 19) as "often" occurring on young roots. Do they not *always* occur? Surely it cannot be true that: "the branches of the axial root are originally growths from the apex of the root thrown off to the side," (p. 538). By some slip of the pen, *Myrica Gale*, is adduced as an instance of whorled leaves (p. 45).

On p. 49 the expression "*over* the petiole" instead of *above* or within it, would lead to a misconception.

Something more might be said about the tendrils of Cucurbitaceæ (which besides are not always single); but are the students of King's College really taught that, "tendrils of the vine are metamorphosed flowering branches *arising in the axils of the leaves?*" (p. 62.)

"In all seeds except in those of the few orders which present an incomplete or acotyledonous embryo" we do *not* find the young plant possessed * * of a plumule" (p. 66). Even some much developed embryos, such as those of Maple and Morning Glory do not show the plumule until after the full development of the cotyledons. It may be said, indeed, that the plumule is *in posse* when not *in esse*, but so it is no less in the cases excepted from the statement.

Very singular is the statement (on p. 68) that in England "the terminal bud of the Lilac is generally killed by the frost in the winter;" since in our much colder winter it is as completely hardy as the other buds whenever it happens to be formed, and, like them, is well developed before summer is over. As a general rule here, and we presume in England also, no terminal winter bud appears during the growing season, and so there is none to be killed by the frost of the following winter.

The deeply alveolate receptacle of the Cotton-Thistle is figured (on p. 78) as an illustration of a *paleaceous* receptacle.

Truly *terminal* flowers are said to be rare (p. 86): we do not quite understand this.

The interesting questions relating to the phyllotaxy and symmetry of the flower are clearly stated, but no new light is brought to bear upon them,—nor all of the old. The opposition of the stamens of Rhamnaceæ to the petals is, as usual, attributed to the probable suppression of an outer stamineal circle, although there is nothing in the blossom (as there is in Geraniaceæ, &c.) to base the supposition upon. And our author has overlooked the most natural of explanations for this and strictly like cases, the one moreover which tells directly against the doctrine of transverse chorisis.—viz., that in these cases of *ante-position* there is a return to normal phyllotaxy, i. e. to the superposition of the corresponding elements of successive whorls,—a view first suggested, we believe, by Lestibudois.

"Real cases of *collateral* multiplication may probably be explained by comparison of a primary staminal leaf with an ordinary compound stem-

leaf, and supposing the filament to subdivide like the petiole does [sic] in such cases." This is certainly the way we regard it; and as respects the application of this hypothesis to the stamens of Cruciferæ, we do not see what argument *Megacarpæa polyandra* brings against it; as the increase in the number of stamens is quite as explicable upon this as upon the ordinary theory. Indeed our author's view that the glands represent suppressed stamens would seem to be negatived by this very case, since the glands have not disappeared with the increase of the stamens, but the contrary.

The abnormal fertile flowers of *Viola* and *Impatiens* are not "achlamydeous," as our author states them to be (p. 90): generally they are not even apetalous.

In the botanical sense of the word, and as it is employed in the same sentence (p. 93) the petals of the vine cannot be said "to cohere above." The valvate petals are merely caducous for the most part before expanding, just as is more decidedly the case in many Araliaceæ. In passing, we remark that a valvate æstivation of the corolla in the latter is much less distinctive than our author supposes (p. 311). *Aralia* itself has the petals imbricated in the bud.

It is becoming common to regard the tube of a so-called *superior* calyx as a cup-like receptacle; and there appears to be reason for it in Cactaceæ and some other cases. Prof. Henfrey would seem to apply this view universally; "for example, in Rosaceæ, Umbelliferæ, Cucurbitaceæ, Compositæ" [!] &c. But if applied to *Rosa*, why not to the Sanguisorbeæ and to other Rosaceæ with a calyx-tube lined with a disk bearing the stamens, &c.? And is the cup a receptacle in those Melastomaceæ which have an adnate ovary, but a calyx when the ovary is free? And how is it when the ovary and cup cohere only by the nerves of the latter?

For *paleæ* Prof. Henfrey coins an English word *pales* (p. 110), of which the singular would probably be *pale*. We would propose to call them *palets*.

There are convincing reasons why the perigynium of Carex cannot be regarded as a perianth, as our author takes it to be (p. 111).

It is not correct to say that the false dissepiments of Datura are formed "while the seeds are ripening" (p. 124); they equally exist in the ovary. And we doubt if the transverse false septa in *Cathartocarpus* and other Leguminosæ are "placental developments."

We are pleased to find that our author prefers to consider placentæ as belonging to the carpels rather than to the axis, although the close of paragraph 226 appears to imply the contrary.

We cannot agree that, "externally the campylotropous ovule resembles the anatropous, except that there is no rhaphe," (p. 130). No attentive student could fail to recognize the difference, especially in the families cited (Cruciferæ and Caryophyllaceæ).

Ripening must be regarded in a remarkably broad sense when it is stated with emphasis, "that the distinction between endocarps and epicarps, in the common stone-fruits, arises entirely during the ripening of fruit." Also: "it is well known that the easy separation of the pulp from the stone is a sign of ripeness." When are cling-stone peaches ripe? Again: "In Taxus * * during the *ripening* of the seed a succu-

lent cup-like envelope grows up around it" (p. 136). Is ripening synonymous with the formation and growth, as well as the maturing of the fruit?

Lindley's system of the classification and nomenclature of fruits is adopted, with some modifications. It is well to have such a system, as an analysis of the diversities of structure; but of the thirty-six kinds so carefully defined and named only fifteen or sixteen are ever used in descriptive botany, or ever will be, it is devoutly hoped. There is much inconvenience in practice, and little advantage in designating every possible modification of the same organ or set of organs by a distinct substantive name, or in distinguishing by separate technical names fruits formed of a simple ovary from those of a compound ovary, or fruits with an adherent from those with a free ovary. Why not call the gooseberry and the grape equally a berry, instead of restricting this name to the former and naming the latter a *nuculanium;* and why name the pod of an Iris a *diplotegia*, while that of a Lily is called a *capsule?* And while we term the pod of *Saxifraga stellaris* a *capsule*, and that of *S. tridactylites* a *diplotegia*, what name are we to apply to that of *S. aizoides*, which is only half-superior?

Probably a wrong example is adduced on p. 148, for we cannot believe that any species of Ranunculus has the rhaphe averse from the placenta in the ripe fruit. By an oversight, on the same page, the fruits of Labiatæ are spoken of as seeds.

As respects the systematic part, the chapters on the principles of classification, nomenclature, &c., strike us as sound and good throughout; and in the account of the natural orders a great amount of information, such as the medical student needs, is given in a comparatively small space. Errors or misconceptions will necessarily occur in the compilation of such an amount of materials, treating of structure, affinities, distribution, sensible properties and medicinal or economical uses. They are not more numerous than was to be expected, and we are not disposed to make them the subject of criticism.

We may remark, in passing, that, as respects the morphology of the androecium in Fumariaceæ, the name of the writer of the present notice is referred to, by some misconception, as adopting Lindley's well-known hypothesis of the splitting of two stamens into halves; whereas he has maintained a very different view. And then this is mentioned as "offering a phenomenon of chorisis," which in that view is quite incomprehensible to us.

We were surprised at the statement that the bark and leaves of *Hamamelis Virginica* "are astringent and contain an *acrid volatile oil*," p. 307. We trace it back to Lindley's *Vegetable kingdom*, p. 784, and find: "The kernels of *Hamamelis Virginica* are oily and eatable. The leaves and bark are very astringent, and also contain a peculiar acrid essential oil;" and this, we find, comes from Endlicher's *Enchiridion*. How did this bland and inert plant acquire such a reputation? Dr. Barton, who has figured it, says nothing of its possessing any sensible properties or useful qualities at all, except its use for divining-rods; nor do Pursh, Bigelow, Elliott, Darlington, &c., allude to any popular reputation of such qualities. No sign of any essential oil is to be detected in the foliage, and prolonged

mastication of the leaves and bark while we write yields not the slightest trace of acridity and hardly any of astringency; no more, certainly, than a Beech-leaf. We never heard of the seeds being eaten; and as they are "about the size of a grain of barley," or not much larger, and have a thick bony coat, they are not likely to become an important article of diet. After some search, we find the source of these extraordinary statements in the *Medical Flora* of the excentric Rafinesque. He says the seeds are called Pistachio nuts in the Southern States, are rather oily and palatable, &c., but he neglects to mention their size. He adds, "the bark and leaves are somewhat bitter, very astringent, leaving a sweetish pungent taste. The smell is not unpleasant. It has not been analyzed as yet, but probably contains tannin, amarine, extractive, and an essential oil." To all this, Endlicher, on the strength of "the sweetish pungent taste," has added the acridity; and so one of the blandest and most useless of shrubs gets a world-wide and wholly factitious reputation for active medical qualities and esculent seeds; and even Dr. Griffith, who must have known the shrub, has been induced to give it a place in his Medical Botany.

Our remaining remark relates to the random way in which mere analogies are mixed up with affinities in estimating or expressing the relationship of orders, &c., in this as in some other more notable works. It is, or at least ought to be, well understood, that mere *analogy*, i. e., likeness in some one respect only, however striking the imitation, is no indication of relationship, but that relationship rests upon *affinity*, i. e., upon agreement or similarity in the whole plan of structure, and especially of floral structure, whether general or particular, as the case may be. To speak, therefore, of 'evident' and 'most distinct' affinities between *Coniferæ* and *Lycopodiaceæ* is an example of this prevalent misconception of what affinity is. This is more intelligible, however, than the 'approach' suggested of *Aquifoliaceæ* to *Loganiaceæ* and *Apocynaceæ*, while their resemblance to *Celastraceæ* is thought to be of small account; or that of *Umbelliferæ* to *Rubiaceæ*, *Saxifragaceæ*, and even to *Geraniaceæ*, to which the resemblances do indeed "seem rather superficial." Again, *Xanthoxylaceæ* (i. e. *Rutaceæ*) are said to have considerable affinity to *Oleaceæ*, because *Ptelea*, in the former, has a samaroid fruit, as has *Fraxinus* in the latter. May we add, as quite as much to the purpose, that the common Xanthoxylums have pinnate leaves, and are popularly called Prickly Ash?

The study of affinities is neither guess-work nor divination, but a matter of logical deduction from structure, based upon scientific principles,—principles recognized and acted upon by sound botanists with considerable unanimity, although they have never been reduced to a system, nor expounded in detail, so as to make them matters of elementary instruction. Until this desideratum is supplied, the young botanist can do no better than to take as models the writings of Brown, and of those botanists who, according to their ability, have most closely followed the footsteps of this master in science.

Having continued this review far beyond our intention at the outset, we have small space left for noticing the best part of Prof. Henfrey's treatise, namely, the third or Physiological part. Suffice it to say that, in the important chapter on the physiological anatomy of plants, our author writes

from the fullness of his acquaintance with the writings and doings of all the continental phytotomists, and also with the authority of an experienced original investigator. And, so far as we know, it comprises much the best *resumé* of vegetable anatomy and development now extant in the English language, at once succinct, clear, trustworthy, and well brought up to the present state of the science. Perhaps the succeeding chapters, on the Physiology of Plants generally, the Physiology of Vegetation, and on Reproduction, are equally commendable in their way; but we have as yet barely glanced over the pages. We like the following definition, and the ensuing paragraph upon the *rôle* of vitality in plants.

"The physiology of plants is that department of botany in which we investigate the phenomena of the *life* of plants, manifested in a series of changes taking place in the diverse parts of which each plant is composed."—p. 475.

"The physiological phenomena which indicate vitality are always of more or less complex nature, and admit of being analyzed into a number of factors, of which a large proportion are found to be purely physical or chemical. A very considerable part of the changes which accompany the process of organization are the results of the action of physical and chemical forces, [and] capable of being explained up to a certain point, by the known laws of those forces. But in every case, after referring all the chemical and physical phenomena to their respective places, there remains a residual phenomenon to be accounted for, which is precisely the most important of all,—namely, that in living organic structures . . . . the laws of inorganic matter are subdued under a higher influence, and caused to undergo modifications never occurring except in the presence of living matter; while—most important of all—the peculiar compounds of matter thus produced are not only made to assume forms, according to definite laws, totally unlike any forms of mineral matter, but [to] constitute bodies manifesting a continued interchange of material with the surrounding media, which, instead of resulting in decomposition, as in mineral bodies, effects a reproduction and increase of the already existing [organized] matter."—p. 542.

In the paragraph on the longevity of trees (p. 549), we find renewed occasion to notice the longevity of unfounded statements, copied from one book into another long after the error has been pointed out. Here again the *Adansonia* of Senegal and the *Wellingtonia* or *Sequoia* of California figure as trees "whose age, deduced from the rings of growth of the stems would amount to upwards of 3000 years." There is really no evidence to prove that the famous Baobabs described by Adanson are of such an age, and as to the *Wellingtonia* in question, an actual counting of the rings has shown that the tree was not half so old as it was vaguely computed to be.

The chapter on Reproduction appears to be excellent, as indeed we should expect. The geographical and geological part is necessarily very briefly treated. A. G.

2. *Naudin's Researches into the Specific Characters and the Varieties of the Genus Cucurbita*, are published in the 6th volume (4th series) of the *Annales des Sciences Naturelles*, and are of no small interest, being founded upon a very conscientious investigation of nearly all the known