The Editors of this Journal, or Prof. Gray of Cambridge, will gladly receive collections of Sponges and Spongillas made in this country, and forward them to Mr. Bowerbank. There are indications of two or more species of Spongilla in our lakes and streams, different from the two European species, and as yet undescribed; and the present opportunity for their thorough investigation should by all means be improved. A. G.

7. *Seeman's Botany of the Voyage of the Herald;* parts IX, and X.—The latter just issued, complete this creditable botanical work. It extends to 483 pages, and to 100 plates, all well chosen and well executed. The 9th fasciculus finishes the collections in North Western Mexico, and give a general introduction to the Flora of Hong Kong: the 10th comprises what purports to be a synopsis of the known plants of this island, 778 in number, a full index to the volume, and 14 pages reprinted to correct errors and give additional information. In one of them is corrected a mistake by which a *Tephrosia* was taken for so peculiar a plant as our *Galactia marginalis*, Benth. The Hong Kong *Compositæ* are elaborated by Dr. Steetz, with his usual conscientious care and good judgment; the *Orchidaceæ* by the younger Reichenbach; the *Cyperaceæ* and *Gramineæ* by Col. Munro; and the *Ferns* by Mr. John Smith. In a neat preface Dr. Seeman takes just credit to himself for having proposed only a very limited number of new genera and species, considering the extent of his collections and the number of little-known countries visited.* He attributes this in a good degree to his having had "the advantage of free access to the largest herbarium in the world, that which the liberality of Sir W. J. Hooker has thrown open to the scientific public; an advantage enabling me to identify most of my plants with already described ones, and preserving botanical literature from a series of synonyms with which under less favorable circumstances, it must and would have been hampered. * * Hence what at first would appear an unfavorable feature, will on second consideration prove perhaps one of the best recommendations of this work." We may add that this advantage would have been of small account, except for the untiring industry of the author and the great knowledge of those who helped him.

Dr. Seeman,—now personally known to the naturalists of the United States, which he has recently visited as the representative of the Linnæan Society to the Montreal meeting of the American Association,—is the editor of the *Bonplandia*, a Botanical Journal, now in the fifth year of its existence, published at Hanover, in monthly numbers, of small folio size. This, we learn is to be enlarged this year, and to contain some floricultural matter. In its new form we trust it will find additional subscribers in this country. The only drawback is the language, of which the German is the staple; but most of the technical matter relating to systematic botany is in Latin; and articles are admitted either in French or in English. A. G.

8. *Dr. J. D. Hooker: On the Structure and Affinities of Balanophoreæ* (separately issued from the *Transactions of the Linnæan Society of*

* To help on a little this laudable diminution of nominal species, we may remark that the only species which Dr. Seeman has proposed as new in the Flora of Western Esquimaux-land (and admirably figured,) viz.: his *Artemisia androsacea*, is doubtless *A. Senjavinensis*, of Besser, from the opposite coast. A. G.

London, vol. xxii). pp. 68, 4to, 16 plates.—Although read before the Linnæan Society nearly three years ago, this fine memoir was published only last summer. The delay has probably been owing, in great part, to the time requisite for the engraving of the very beautiful and elaborate plates which illustrate the memoir. It is a clear, patient, and philosophical elucidation of an extremely anomalous group of plants, and a succinct exposition of the principal lessons to be learned from their study, both organographically and systematically; and it bears the impress throughout of the spirit, freshness, and independence which so distinguish this author, and make all his writings so attractive and instructive. While the whole subject is developed in proper order, the divisions are not quite clearly marked out in the essay. The first sectional heading is "1. *Parasitism and Structure of the Rhizome.*" But there is no section 2 answering to the first, which, moreover continues, without a break, to treat of the general anatomy, organography, and morphology of these plants, the structure of the flowers, ovules, and seeds, and of the diverse doctrines which have been propounded respecting them. The *Affinities of Balanophoreæ* are then considered, under a special heading; their *Classification* is then the subject of a few general remarks; also their *Geographical Distribution and Variation.* Then a Synoptical Table of the genera is given; and the 14 genera with their known species (28 in all) are finally described and illustrated.

As to the structure and affinities of *Balanophoreæ*, and the curious questions that have arisen about their place in the natural system, Dr. Hooker, in the first place, affirms them to be truly phænogamous. It now seems strange that this should ever have been doubted. The arguments to the contrary, says our author, "all appear to have originated, on the one hand, in mistaking feeble analogies between the forms of organs that are not homologous, for affinities; and, on the other, in overlooking a multitude of positive characters. These arguments may be summed up as:—1. An erroneous view of the nature of the seeds, by Endlicher, Martius, Blume, and others, who describe them as a sporuliferous mass,—a term which, even if it were applicable, has no meaning. 2. An erroneous view of their origin being in a diseased state of the plants they grow upon, adopted by Junghuhn and Trattinick. 3. A supposed similarity in appearance to *Fungi*, and an erroneous idea that their appearance is meteoric and their growth rapid;—a theory advanced by Endlicher, who says of the horizontal rhizome of *Helosis* and *Langsdorffia*, "mycelio Fungorum quam maxime analogum." 4. The resemblance between the articulated filaments on the capitula of the *Helosideæ* and the paraphyses of *Musci;* and between the pistils of *Balanophoreæ* and the pistillidia of Mosses; strongly advocated by Griffith and Lindley. 5. The resemblance of the cellular and vascular tissues in some of their characters to some of those of Filices, as indicated by Unger and Gœppert. 6. A very peculiar view of the nature and relations of the parts of the female flower entertained by Weddell; who hence considers *Balanophoreæ* (together with *Rafflesiaceæ*) to approach nearer to Gymnosperms than to any other group of plants." Instead of discussing at length opinions which "had the authors who advocate them been sufficiently furnished with specimens and facts they would never have entertained,"

Dr. Hooker merely recalls attention to the essential facts that these plants exhibit true flowers with stamens and pistils, genuine ovules, and even embryo, and so accord in no one particular with Cryptogams. He shows moreover that the embryo is dicotyledonous in the few cases where it is sufficiently developed to manifest the character, and that the stem is constructed upon the exogenous plan. Even with these facts before him Lindley has retained his *Rhizogens*, as "logically a class;" as an intermediate form of organization between *Endogens* and *Thallogens*, and characterized by vegetation rather than fructification. But there is little or nothing really peculiar in their vegetation; and, as Lindley himself reduces the differences to questions of degree, it suffices to say that classes are not founded upon degradation of type, but upon change of type.

Viewing *Balanophoreæ*, then, as degraded members of the Dicotyledonous class, Dr. Hooker follows Brown and Griffith in regarding *Rafflesiaceæ* as near to *Aristolochiaceæ*, and in denying all affinity between these and *Balanophoreæ*. In searching for the affinities of the latter, Dr. Hooker is guided by the sound rule of disregarding "the negative characters, as those may be termed which are founded on the imperfection of organs;" and he takes the most perfectly developed species as the best exponents of the typical structure of any group,—a principle laid down, we believe, by Mr. Brown. This gives a substantial scientific basis for the estimation of affinity. Agreement *in plan of structure* is just what constitutes affinity; agreement in *grade of evolution* may indicate only distant analogy, can indicate only collateral relationship,—not to be neglected, indeed, but in itself of no account in assigning a family to its true position in the system. The principle as applied in the present case leads Dr. Hooker to the conclusion that the nearest relatives of *Balanophoreæ* are the *Haloragеæ*, a group itself "consisting for the most part of reduced forms of *Onagrarieæ*," or more strictly speaking, that the link which connects these plants with the higher forms of vegetation is furnished by *Gunnera*. The qualifying phrase above is appropriate; for it is hard to conceive of *Gunnera* with its minute embryo as a reduced *Onagracea*, while it is impossible to sever the chain of evidence which binds the genus to *Loudonia* and *Haloragis*. Be this as it may, Dr. Hooker has surely made a happy hit, in seizing upon *Gunnera* as the key to the true affinities of *Balanophoreæ*. Of all the objections that may be urged against this approximation not the strongest, but rather the least valid, in our opinion (so long as the question is one of alliance and not of co-ordination), is that to be derived from the habit and the imperfection of the foliar organs. Any type is liable to have its parasitic phase, and this is generally a degraded one in these respects; the Gesneriaceous has it in *Orobancheæ*, which it might with the greatest propriety include; the Scrophulariaceous graduates insensibly into similar parasitic forms; the Ericaceous has them in *Monotropeæ;* and the Cornaceous or Olacaceous degrades through *Santalaceæ* into *Loranthaceæ*.

It is quite probable that our author would deny the *degradation* in the latter case, judging from some points which he makes when considering whether the group of *Balanophoreæ*, "putting aside any consideration of its relationship with other orders, and regarding it *per se*, ... should abstractedly be considered as ranking high, or the contrary." This is an

abstraction of which we are hardly capable,—that of determining the rank of an order *per se*. Still our author's ideas are clear and clearly expressed: the comparison is really between these plants and the ideal plant-type. And what is wanting to make the comparison practical is a settled idea as to what constitutes the highest style of plant, and what is the relative importance of deviations from it;—questions too large to be entered upon here, if indeed the science is yet ready for their discussion, but which underlie the most important inquiries which good systematic botanists are everywhere tentatively prosecuting. "Assuming that the conventional definition of perfection in use among zoologists is applicable to the vegetable kingdom, and which argues that a high degree of specification of organs and morphological differentiation of them for the performance of the highest functions, indicate a high rank, Dr. Hooker ingeniously argues that "*Balanophoreæ* may in some respects be considered to hold a very high one;" and the points are presented under seven heads. Now we will not deny that the principles are logically applied in the present case, nor that considerations of the kind are perhaps as applicable to the vegetable as to the animal kingdom. But we should *a priori* expect that principles of fundamental importance in the latter could have no sound application to the former; that even such as relate to functions common to the two, or to structures analogous, would require to be based each upon its own ground. As to morphology, and as to what constitutes perfection of type, we should look to the fundamental differences rather than to the resemblance of the two for our starting point.

Plants, for obvious reasons, are constructed on the principle of extension of surface. Concentration or consolidation, wherever it occurs in the vegetable kingdom, is a special provision against some peculiar danger. Animals, on the contrary, are formed on the principle of restriction of surface. As if to withdraw them as much as practicable from the direct action of the external world, their shape is compact, their extent as individuals strictly limited, the external organs by which they take their sustenance comparatively few and small, while the most essential organs are safely sheltered within. Consolidation of organs and even their restriction in number, accordingly are not likely to be indications of high rank in the vegetable kingdom. Not the latter, because the object of the plant in vegetation is attained by the indefinite repetition of the same organs; nor the former, for the type of the plant is realized only in the distinct elimination of leaves from the axis. A Melon-Cactus, and a Cuscuta are low forms of plants as to vegetation. As it is a fundamental character of plants that their organs of reproduction are only specialized organs of vegetation; as the higher great divisions of plants are those in which the leaf-type is most apparent throughout; as the perfect accomplishment of the end in view,—the production, protection, and nourishment of the embryo even of the highest or most developed kind,—does not require the confluence of homogeneous parts, why should such confluence be regarded as indicating higher rank, merely because the type is more disguised in such cases? We see no sufficient ground for ranking a monopetalous plant higher than a polypetalous one on that account; and still less for regarding a *Loranthus* or a *Viscum* as the highest style of plant. On

the contrary, we incline to look upon the consolidation of heterogeneous parts in the blossom not as high specialization at all, but as want of development, i. e. imperfect elimination; and in this light those who maintain an inferior ovary to be one immersed in a receptacle, must needs regard it.

Again suppression or abortion of organs which belong to the type of the blossom cannot be considered as other than an imperfection, although the loss of the corolla is no great matter, and the abortion of one of the sexes little more. Still hermaphroditism is plainly in the type of the highest style of plant; while the opposite is the case in the animal kingdom. But we cannot here enter further into the discussion of this class of questions. No one feels more deeply than our author the want of fixed and philosophical principles for the subordination of characters and the study of affinities in plants; and no botanist of his age is more competent, or so well placed and furnished for the investigation of this problem, to which we invite him, as to a task worthy of his powers.

As to the rank of *Balanophoreæ*, if our author has demonstrated anything, it is that they belong to the highest class of plants, but that they are probably the most degraded members of it. A. G.

9. *Boussingault: Researches upon the influence which assimilable nitrogen in manures exerts upon the production of vegetable matter, and* (2.) *Upon the quantity of nitrates contained in the soil and in water of various kinds* (Ann. Sci. Naturelles, ser. 4, vol. 7, No. 1, 1857).—Several years ago Boussingault demonstrated, in the clearest way, that plants are incapable of assimilating the free nitrogen of the atmosphere. Two years ago, in a paper communicated to the French Academy of Sciences, he showed that nitrates eminently favor vegetation. He now shows, by decisive experiments,

(1.) That the amount even of ternary vegetable matter produced by a plant depends absolutely upon the supply of assimilable nitrogen (ammonia and nitrates). A plant, such as a sunflower, with a rather large seed, may grow in a soil of recently calcined brick, watered with pure water, so far as even to complete itself by a blossom; but it will only have trebled or quadrupled the amount of vegetable matter it had to begin with in the seed. In the experiments, the seeds weighing 0·107 grammes, in three months of vegetation formed plants which when dried weighed only 0·392 grammes,—a little more than trebling their weight. The carbon they had acquired from the decomposition of carbonic acid of the air was only 0·114 grammes; the nitrogen they had assimilated from the air in three months was only 0·0025 grammes.

(2.) Phosphate of lime, alkaline salts and earthy matters indispensable to the constitution of plants exert no appreciable action upon vegetation, except when accompanied by matters capable of furnishing assimilable nitrogen. Two plants of the same kind, grown under the same conditions as above, but with the perfectly sterile soil adequately supplied with phosphate of lime, alkali in the form of bicarbonate of potash, and silex from the ashes of grasses, resulted in only 0·498 grammes of dried vegetable matter, from seeds weighing 0·107 grammes; and had acquired only 0·0027 grammes of nitrogen beyond what was in the seeds.