Institutes of botany; : containing accurate, compleat and easy descriptions of all the known genera of plants: translated from the Latin of the celebrated Charles von Linné, Professor of Medicine and Botany in the University of Upsal; First physician to the King of Sweden, Knight of the Polar Star, and member of the most learned societies in Europe. To which are prefixed, I. A view of the ancient and present state of botany. II. A Synopsis, exhibiting the essential or striking characters which serve to discriminate genera of the same class and order; as likewise the secondary characters of each genus, or those derived from the port, habit or general appearance of the plants which compose it. / By Colin Milne, Reader on Botany in London, author of the Botanical Dictionary.

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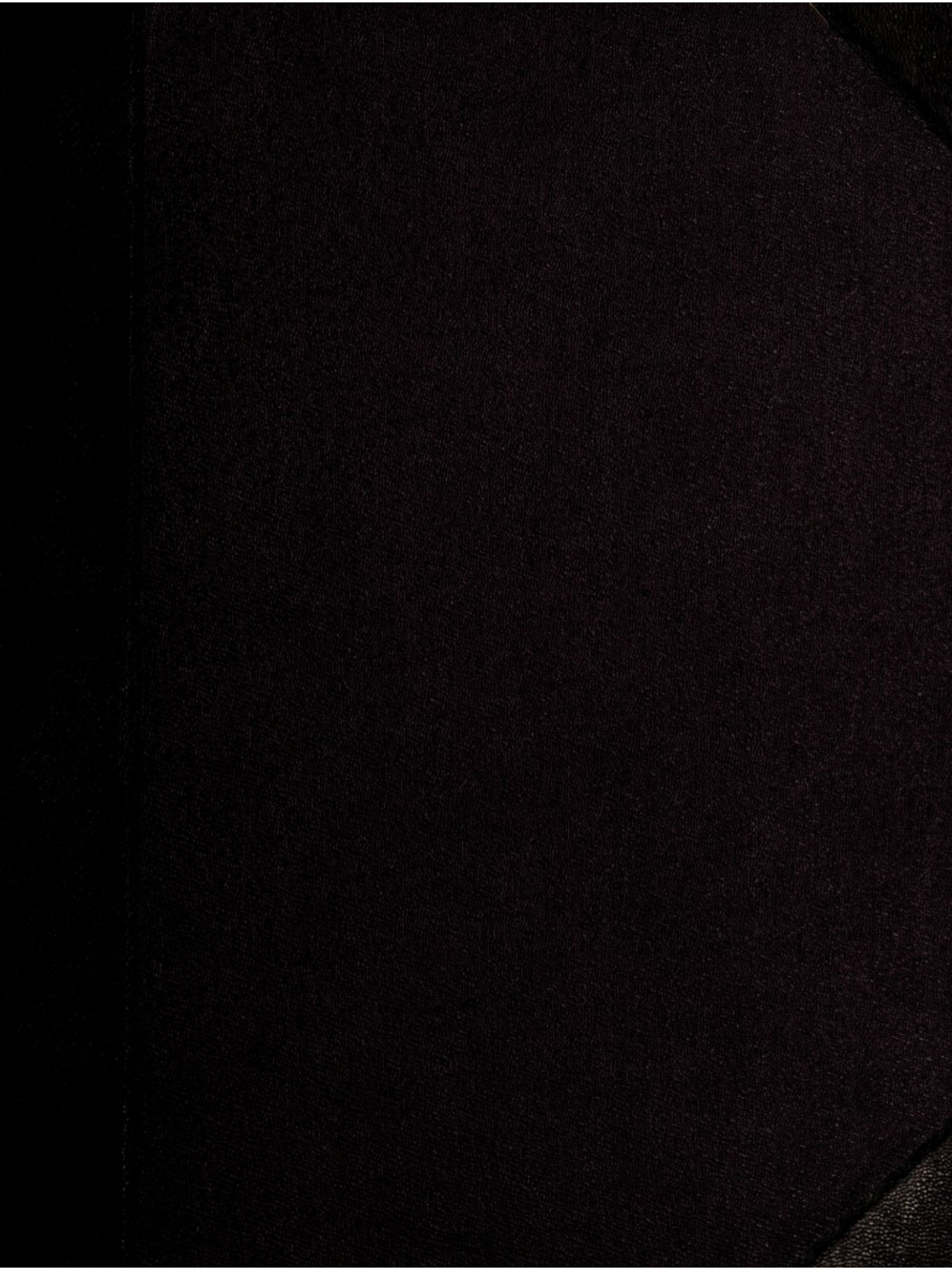

INSTITUTES

OF

BOTANY;

CONTAINING

Accurate, compleat and eaſy Deſcriptions of all the known

GENERA OF PLANTS:

Tranſlated from the Latin of the celebrated

CHARLES VON LINNÉ,

Profeſſor of Medicine and Botany in the Univerſity of Upſal; Firſt Phyſician to the King of Sweden, Knight of the Polar Star, and Member of moſt of the Learned Societies in Europe.

To which are prefixed,

I. A View of the ancient and preſent State of Botany.

II. A Synopſis, exhibiting the eſſential or ſtriking Characters which ſerve to diſcriminate Genera of the ſame Claſs and Order; as likewiſe the ſecondary Characters of each Genus, or thoſe derived from the Port, Habit or general Appearance of the Plants which compoſe it.

By COLIN MILNE,

Reader on Botany in London, Author of the BOTANICAL DICTIONARY.

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M, DCC, LXXI.

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LONDON:

ADVERTISEMENT.

A Tranſlation of the GENERA PLANTARUM has not hitherto been attempted in any language, notwithſtanding the great reputation of its ingenious author, the diſtinguiſhed taſte of the preſent age for improving and diffuſing natural knowledge, the excellence of the work itſelf; and, above all, its indiſpenſible uſe to every botanical ſtudent. The characters of claſſes and orders, the primary diviſions in every method, are generally conſtituted from a ſingle circumſtance; ſo that genera, without the aſſiſtance of accurate and compleat deſcriptions, may be eaſily referred to their proper place in the arrangement. But in detecting the genera of plants, or referring any particular plant to its genus or aſſemblage, ſuch a complication of circumſtances muſt neceſſarily paſs under review, ariſing from a compariſon of all the parts and modifications of the flower and fruit of the plant in queſtion, with thoſe of the genera of the ſame claſs and order, that it is impoſſible, without the aid of deſcriptions, and thoſe full and accurate,

to

to advance a ſingle ſtep with certainty and preciſion. To the learned and claſſical reader, the GENERA PLANTARUM, in its original form, ſerves every purpoſe of information for which it was intended; but to the illiterate and unclaſſical, who, by the way, conſtitute the bulk of thoſe whom inclination or chance have directed to the ſtudy of plants, that form proves an inſurmountable obſtacle. It deſerves likewiſe to be mentioned, that many Ladies who would apply with indefatigable attention to the ſcience of plants, are denied the pleaſure reſulting from ſuch a ſtudy, for want of proper aſſiſtance in a language which they underſtand.

FOR theſe reaſons, it appeared highly probable that an Engliſh tranſlation of the GENERA would prove not altogether unacceptable to the public. To render it, in ſome meaſure, more compleat, the Tranſlator has preſented the reader with a Prefatory *View of the ancient and preſent State of Botany*, including a particular analyſis and illuſtration of every plan of arrangement which has appeared ſince the origin of the ſcience. The utility of ſuch a diſcuſſion is too obvious to be inſiſted on. In characteriſing the ſeveral authors which paſs under review, the Tranſlator is not conſcious of having indulged malevolence, or diſcovered want of candour. The merits and defects of each method are,

are, to the beſt of his judgment, impartially ſtated; their comparative excellence it is the province of the intelligent botaniſt to eſtimate and determine. He hopes it will not be imputed to him as a fault, that, in a few controverted points, he has ventured to differ in opinion from ſome of the moſt diſtinguiſhed names in Botany. Such diſſent has been always accompanied with reaſons which, to him, appeared ſatisfactory: if they appear otherwiſe to the reader, he is at freedom to think for himſelf, and reject the opinions, ſo lamely defended, as heretical and erroneous. Throughout the work, he has endeavoured to expreſs himſelf with perſpicuity and preciſion; and, in enumerating the characters of the genera, has carefully avoided that affected conciſeneſs which has lately crept into botanical deſcription, and is totally repugnant to the genius of our language.

Upon the whole, the Tranſlator flatters himſelf that his hopes of ſucceſs are by no means equivocal. The attempt ſurely needs no apology: the execution muſt ſpeak for itſelf. The Tranſlator has devoted his whole time and attention to the ſtudy of plants. In that department he deſires to be uſeful to the Public: and if, in the courſe of his repeated endeavours, he ſhall be happy enough to remove that air of myſtery, and diſpel thoſe clouds of obſcurity in which he found

his

his favourite ſcience involved, he doubts not that the Public, enemies to the monopolizers of knowledge, and ever diſpoſed to encourage laudable purſuits, will candidly acknowledge that he has obtained his wiſh.

The Tranſlator cannot conclude without offering his grateful acknowledgments to all the friends and well-wiſhers of this work, and particularly to John Hyde, Eſq; Governor of the London Aſſurance, and Fellow of the Royal Society; by whoſe generous aſſiſtance he has been enabled to carry it on. With pleaſure could he expatiate on that univerſal benevolence, that unbounded deſire of doing good, which characteriſe every action of this beſt of men, the value of whoſe favours is ſo greatly enhanced by the exalted motives from which they proceed, and the truly engaging manner in which they are conferred. But he knows the extreme delicacy of the ſubject, and ſhall therefore forbear: happy if he has not incurred his diſpleaſure by giving this ſmall, though heart-felt, teſtimony of his goodneſs.

A VIEW

A

VIEW

OF THE

ANCIENT AND PRESENT STATE

OF

BOTANY.

Including a particular Illuſtration of every Plan of Arrangement which has appeared ſince the Origin of the Science.

Filum Ariadneum Botanices eſt SYSTEMA, ſine quo Chaos eſt Res Herbaria.
Lin. Phil. Botan. P. 98.

Quid unquam Botanica, vel quis Botanicus abſque Methodo?
Lin. Claſſes Plant. in Præfatione.

A VIEW OF THE ANCIENT and PRESENT STATE OF BOTANY.

SECTION I.

Characteriſtical Diſtinctions of the Three Kingdoms of Nature.

ALL natural bodies conſidered *in cumulo* agree invariably in certain qualities, hence ſtiled the Univerſal Qualities of Matter. Theſe are Extenſion, Figure, Mobility, Diviſibility and *Vis inertiæ*. Every body is extended, has figure, may be moved, is diviſible into parts, and is ſluggiſh or inactive. The univerſal properties of matter, juſt mentioned, are the objects of Natural Philoſophy: but being poſſeſſed indiſcriminately by all bodies, become neglected in Deſcriptive or Natural Hiſtory, where the ſubjects are arranged, not from circumſtances of univerſal ſimilitude, but the contrary.

THE quieſcent forms of bodies, and their co-exiſting qualities, about which Deſcriptive Hiſtory is converſant, ſufficiently diſtinguiſh it from Narrative Hiſtory, whoſe object is active nature, the operations of which are exceedingly diverſified.

MAN, with reſpect to the anatomy of his body, is, in ſome meaſure, a ſubject of deſcription. Such variety, however, does he exhibit in point of character, talents, capacity, ingenuity and force, that each individual of the ſame age is ſufficiently diſtinguiſhed from every other; nay, whole races and ages of men are diverſified in like manner: ſo that human affairs are much more properly the ſubject of Narrative than Deſcriptive Hiſtory. Thoſe only are, with propriety, to be ſtiled ſubjects of the latter, where the deſcription of a ſingle individual exhauſts the deſcription of the ſpecies to which ſuch individual belongs. As individuals conſtitute a ſpecies, ſo a number of different ſpecies agreeing invariably in certain circumſtances, conſtitutes a genus or kind; and genera, having reſemblances of the like nature, form higher diviſions or claſſes. Thus the principal object in Deſcriptive Hiſtory is to form theſe diviſions of the ſubjects to be deſcribed; and, for that purpoſe, to enquire minutely into their nature, their different parts, and their reſemblances; as it is upon the circumſtances of ſimilitude and contraſt that the Method or Arrangement in Deſcriptive Hiſtory depends. This method of combining different ſubjects under a point of reſemblance, is an act which the mind is continually exerting in the acquiſition of knowledge. No fact or particular is left ſolitary or detached. The mind naturally looks for its help-mate; and, by regarding many different ſubjects under one point of view, facilitates its progreſs in each attainment. We are always led to generalize. We do ſo in Deſcriptive Hiſtory; we comprize ſeveral ſpecies under one genus, and ſeveral genera under one claſs or order, where the

the reſemblance in each particular ſpecies or genus is invariable and ſtrongly marked. Thus for the purpoſe of acquiring knowledge eaſily, we generalize, we arrange, we ſeek grounds of reſemblance. In Narrative Hiſtory, where nature is conſidered as active, we generalize her operations; and what in the combination of mere quieſcent forms, was only matter of arrangement, becomes here a foundation of ſcience, a law, a principle. It is in this way, that the flight of projectiles, the motions of the planets, the flux and reflux of the ſea, and a variety of other operations and appearances in nature are adequately explained by Sir Iſaac Newton on the principle of gravitation, and the firſt law of motion. From Narrative Hiſtory then we attain principles of ſcience, by generalizing, or viewing combinations of effects in their points of reſemblance. By generalizing in Deſcriptive Hiſtory, we obtain combinations from ſimilitude, which conſtitute the knowledge of mere arrangement.

The operations of nature being but different combinations of her quieſcent forms in an active ſtate, it is abſolutely neceſſary that our knowledge of the quieſcent forms ſhould precede that of active nature. Hence Natural Hiſtory ſhould precede Natural Philoſophy, where operations are generalized, and principles of ſcience thence obtained.

The firſt and moſt obvious diviſion of natural bodies that would preſent itſelf, is that into Animals, Vegetables and Minerals; or, as they are commonly deſigned, the Three Kingdoms of Nature. In making this diviſion, we loſe ſight of the points in which theſe three different claſſes of bodies concur, and only pay attention to the circumſtances in which they differ. It requires, however, a perfect knowledge of all the natural bodies on this globe, and their moſt intimate qualities, to form charac-

teriſtic differences which ſhall include every individual of one diviſion, and exclude the individuals of every other. As ſuch a knowledge has never yet been attained, we have not been able to fix preciſe boundaries to any of theſe kingdoms. The marches are ſtill obſcure and undecided: and ſuch uncertainty indeed has prevailed on this ſubject, that ſome learned Naturaliſts have diſputed the diviſion, being inclined to believe that all natural bodies are comprized in a kind of ſcale or chain, whoſe gradations are beautifully marked by the great variety in all the parts of Nature's productions. Man, as poſſeſſed of thought and intelligence, is placed at the top of this ſcale. The inconceivable variety among men ariſing from genius, character, capacity and force, gives riſe to as many degrees upon the ſcale of intelligence. As we deſcend, Reaſon ſeems to loſe itſelf, and be confounded with the finer inſtincts of the higher kinds of animals; as the monkey, elephant and horſe. Thus it is, they ſuppoſe, that the ſeveral beings in the world poſſeſs a place in this ſcale; and that ſuch is the number of gradations, and ſo inſenſible their progreſſion, that the lower link in a particular claſs of beings is, by imperceptible ſhades, connected with the higher link of a claſs of beings inferior in their nature to that immediately above it. It is in this manner that they would connect the moſt ſeemingly imperfect animals, as the Polypes, with the Senſitive Plant, which for that reaſon they conſider as joining the Vegetable and Animal Kingdoms. The Vegetable, which poſſeſſes the middle place, is likewiſe ſuppoſed to be connected with the Mineral Kingdom on the other hand. The duſty Byſſus, a ſpecies of Flag, ſcarce enjoys an apparent diſtinction from the earth on which it grows.

INGENIOUS however as this Scale of Beings undoubtedly is, and great as is its utility both in theory and practice, it ſeems moſt probable, that the three Kingdoms of Nature are perfectly diſtinct

distinct from one another, though men have not hitherto been extremely successful in establishing the characters of each division. The truth is, that the amazing variety which obtains among natural bodies, so characteristic of Omnipotence, proves highly unfavourable to either position, and must render imperfect any method of division which can possibly be devised. For if we ascend from the irregular coalescence of the mass of earth in the mineral kingdom up to man, as the most perfect animal, several bodies are found in the vast intermediate space, which cannot be reduced but with the utmost difficulty into any certain and definite series.

Diversity of form in the same species is assigned by Ludwig, as the distinctive character of minerals; whilst locomotive powers, according to that author, sufficiently distinguish the animal from the vegetable. "When we attend," says Ludwig, "to the difference of natural bodies, we observe in some, "constantly the same form, arising from the figure, situa- "tion, connection and proportion of the parts: in others, "we observe no such invariable form, but are led to de- "termine their nature, from the mixture or aggregation of "the parts. The former are called Vegetables and Ani- "mals, and proceed from seed, and from an egg; the latter "Minerals, and arise from the coalition of particles meeting to- "gether from a variety of causes.

"The seed being the vegetable egg, the difference now ad- "duced serves not to discriminate vegetables from animals. "Betwixt these, however, a manifest difference obtains. For, "whilst vegetables are devoid of loco-motive powers; that is, "cannot transport themselves, by proper organs, from place to "place; the animal can perform his appointed motions by the

"parts

" parts proper to his frame; ſo that even if he is at reſt, we may " obſerve a diſpoſition or aptitude in his ſeveral limbs to un- " dertake their reſpective motions.

" NATURAL bodies, then, which have always the ſame " form or appearance in the ſame ſpecies, and are endued with " the power of motion, are called Animals, and are ſubdivided, " principally from the organs of progreſſion, into quadrupeds, " birds, fiſhes, amphibious animals, worms and inſects. The " doctrine of animals is termed Zoology.

" NATURAL bodies which have always the ſame form in the " ſame ſpecies, and are devoid of loco-motive powers, are called " Vegetables or Plants. The doctrine of vegetables is termed " Phytology or Botany.

" NATURAL bodies which have a different appearance in the " ſame ſpecies, and although they frequently agree in the inter- " nal maſs, differ in external ſtructure, are called Minerals. The " doctrine of minerals is termed Mineralogy. This kingdom " of nature is frequently ſtiled the foſſil kingdom, becauſe ſeveral " bodies pertaining to it are dug out of the bowels of the earth. " Others, as Linnæus, call it *regnum lapideum*, becauſe the great- " eſt part of bodies belonging to it have earth for their baſis. " The term Mineral, is, perhaps, to be preferred, as ſeeming " to indicate a body formed by the coalition of earthy particles " variouſly mixed together.

" WE allow," ſays Ludwig, after enlarging upon this diſtinction, " that the differences juſt propoſed, are often not ſuffi- " ciently circumſcribed in their limits. The *urticæ marinæ*, " and other zoophytes, ſeem to open a communication betwixt

" animals

" animals and vegetables; as do the moſſes, lichens, lithophyta " and chryſtals betwixt the latter kingdom and that of mine- " rals. Yet as the principal claſſes of natural bodies" (continues he) " may thence be certainly enough defined, we reſt in this " diviſion, being perſuaded that doubts of a ſimilar nature will " ariſe upon the foundation of any mode of arrangement what- " ever."

FAVOURABLY, however, as Ludwig is inclined to think of this diſtribution, it is far from being either exact or ſatisfactory. Chryſtals and petrefactions have always a regular figure in the ſame ſpecies. There are plants which are not fixed to one place, and animals which are, as Corallines, and ſome of the teſtaceous tribe. Linnæus's diſtinction, after Jungius, is much more accurate. " Lapides creſcunt; vegetabilia creſcunt & vivunt; " animalia creſcunt, vivunt & ſentiunt." That is, as it is well illuſtrated by a modern author, minerals have increaſe without life, organized parts, regular growth or ſenſation. Vegetables have a regular growth and a degree of life, but no ſenſation. Animals grow, live and feel. Minerals have no veſſels. Vegetables have veſſels for their nutritive juices. Animals have nutritive veſſels and nerves, a peculiar and diſtinct ſyſtem and the cauſe of ſenſation. Here then we have found an eſſential, univerſal and invariable difference of the three great claſſes or kingdoms of nature. Minerals wanting veſſels, though they may be encreaſed by an addition of parts, cannot have a regular growth; for that muſt depend on organized veſſels. Plants having veſſels, may have a regular growth; for it is the effect of their proper office: but wanting nerves, they cannot feel; that being the quality of nerve alone. Animals, which have nutritive veſſels and nerves, grow and feel; theſe being the offices of thoſe two ſyſtems.

THIS

THIS fixed character being eſtabliſhed, the ſenſitive plant and ſome other well-known inſtances ſtill recur. All that can be ſaid with reſpect to ſuch inſtances is, that they are exceptions to the general law of their being; for nature makes all her changes by minute gradations, and leaves no great gap in the univerſal chain. In fine, a diſtinctive character being eſtabliſhed, there can be little difficulty or confuſion.

VEGETABLES then are placed in a middle ſtate, between the ſentient animal and the unorganized mineral; inferior to the former, ſuperior to the latter. Animals and vegetables agree in many particulars. They grow, and are nouriſhed. They are furniſhed each with an organized ſtructure, that is, conſiſt of parts which co-operate in producing the changes that are effected in their frame. The nouriſhment, which they receive in a very different manner; the vegetable from the ſoil in which it is placed; the animal ſearching about in queſt of it; is filtrated through the veſſels, and by a proceſs which we cannot explain, aſſimilated to the ſubſtance of the plant or animal, ſo as to repair its waſte, and increaſe its growth. Thus an analogy manifeſtly obtains betwixt vegetation and the animal œconomy. The root attracting moiſture from the ſoil, and abſorbing it, may aptly enough be compared to the ſtomach and lacteals of animals; the courſe of the ſap to the circulation of the blood; the abſorption of the redundant moiſture by the ſun, to animal perſpiration. Accordingly ſuch terms have been invented, and we ſpeak of the circulation of the ſap, the perſpiration and reſpiration of plants. Strong, however, as this analogy is, we cannot explain any of the facts in the one ſubject by thoſe of the other. Their laws and *modus operandi* are quite diſtinct. No fact in vegetation can explain animal heat. In fine, mechanics, vegetation, animal œconomy, and intelligence, are ſubjects that are quite diſtinct, totally independent, and can never explain each other.

SECTION

SECTION II.

The extent of Botany, its advantages, and the obſtacles that have retarded its progreſs.

THE preceding ſection eſtabliſhed the geography of my ſubject, by fixing its limits, and aſcertaining its preciſe place in the extenſive department of natural knowledge. I propoſe, in this ſection, as a proper introduction to this part of the work, to lead the reader into an enquiry reſpecting the advantages which attend the ſtudy of Botany, the extent of that ſcience, and the difficulties which have proved obſtructive of its progreſs.

NATURAL hiſtory, in its ſeveral branches, is an entertaining as well as uſeful ſtudy. To the former of theſe characters, none, I am confident, will diſpute its claim. Thoſe even who have been moſt laviſh in invectives, allow it to poſſeſs this merit: if that can, with propriety, be ſaid to poſſeſs any merit whatever, which has not utility to recommend it. And, indeed, what ſtudy can be more entertaining; nay, I will go farther, what can be a more rational and manly ſtudy than that by which we attain an acquaintance with the works of nature! The curious inſtincts of animals, the beautiful variety in the vegetable tribes, the hidden wonders of the foſſile kingdom, are objects which awake attention, and prove an inexhauſtible fund of pleaſure and delight.

INDEPENDENTLY of its utility, the ſtudy of natural hiſtory is with peculiar propriety recommended to ſuch as enjoy ſtill life, or who intend to viſit foreign countries.

NOTHING can be more ſuited to the innocence and gay ſimplicity of the country than the ſtudy of Botany. No ſituation can be more favourable for ſuch a ſtudy. The country is Nature's perpetual reſidence; it is there ſhe puts on her richeſt attire; it is there ſhe appears in her moſt engaging charms: and void is he of ſenſibility indeed, who can view with unconcern ſuch artleſs beauties!

To acquire a knowledge of the natural productions of their own country is now pretty generally an object with gentlemen who enjoy the advantages of a liberal education. To travel with profit, we muſt extend our views. From difference of ſoil, climate, and a variety of concurring cauſes, nature, in different countries, aſſumes very different appearances. Let us familiarize ourſelves to theſe appearances, and, not contented with a bare knowledge of nature as ſhe exhibits herſelf to us at home, let us view her in the various modes and dreſſes which ſhe is pleaſed to aſſume.

A TRAVELLER very naturally enquires into the geography of the countries which he purpoſes to viſit, their boundaries, extent and ſituation, their cities, mountains and rivers; the manners and cuſtoms of the people, their policy and government. The man, curious in nature, will go a ſtep farther; he will make himſelf acquainted with the internal geography, if I may be allowed that expreſſion, of the different countries through which he is to paſs. His knowledge will not be confined to the ſituation and extent of rivers, foreſts and mountains; he will likewiſe know what

what he is to expect in those rivers, in those forests, and on those mountains.

I SAID, that natural history is an useful study. Can we for a moment doubt it, when we recollect that it furnishes one of the strongest arguments for the existence of a supreme intelligent Being? To produce a stronger proof of its utility is impossible: to enforce the study from other motives is unnecessary. The works of God are the most easy and intelligible demonstrations of his being and attributes; and he who carefully studies those works may be truly said, in the beautiful language of the poet, "To look through nature up to nature's God."

BUT to be convinced of the utility of Botany, let us consider its extent. And here it is to be observed, that, in our researches into natural bodies, we either pay attention to the external surface only, and the corporeal properties obvious to the senses, particularly to that of sight, and thence institute the distribution into genera and species; or we search into the internal fabric, by dissecting or resolving the parts which are constituent of the bodies, and thence deduce their origin and changes. The knowledge resulting in the first case is called the historical knowledge of nature, or natural history, properly so called; in the latter case, the scientific or physical knowledge of nature. What obtains with respect to natural history in general, holds also in considering the parts of which it is composed. Thus, Botany, a part of natural history, is either historical or physical. Physical Botany, or the philosophy of plants, treats of the constituent parts of vegetables, their internal fabric or structure, their fluids and solids, and the motion of the former through the latter. Hence the circulation of the sap, the perspiration and respiration of plants by the leaves, and a variety of curious phæ-

nomena in the vegetable œconomy connected with gardening, arrange themſelves under the extenſive head of Phyſical Botany.

IMPORTANT as the philoſophy of plants certainly is, it cannot be denied, that the various diſtributions into ſpecies and genera from circumſtances of reſemblance in the external forms and appearances of plants, and the numerous ſyſtems or combinations thence ariſing, are the proper objects of Botany. Hiſtorical Botany then is Botany properly ſo called; and to have an accurate and extenſive diſtinctive knowledge of plants, as connected by ſimilitude, or ſeparated by contraſt, is to be an expert botaniſt. "Botanicus," ſays Linnæus in the Preface to his *Genera Plantarum*, "eſt ille, qui vegetabilia ſimilia ſimilibus, & "diſtincta diſtinctis nominibus, cuicunque intelligibilibus, noſcit "nominare." The ſame idea predominates in Boerhaave's definition of Botany, which, according to that learned author, is "a part of natural knowledge, by means of which, plants are "moſt certainly and eaſily known, and engraved on the me-"mory."

BUT whither does all this tend? For as yet we have ſeen no uſeful purpoſe that ſuch a diſtinctive knowledge, however extenſive, is calculated to promote. Is it then to be acquired merely for its own ſake? Or would the pleaſure derived from ſuch an uſeleſs acquiſition make amends for the labour and time which had been ſo improperly and fruitleſsly beſtowed? Let us pay attention to theſe queries; they will, perhaps, lead us to obviate one of the ſtrongeſt objections that can be made to the ſcience of Botany.

I BEGIN with obſerving, that a diſtinctive knowledge of the ſeveral orders of plants, ſuch as can be acquired by inſpection alone, the moſt intimate acquaintance with the various reſemblances

blances and contraſts upon which thoſe orders are founded, are of little importance conſidered by themſelves. A man poſſeſſed of ſuch knowledge, without applying it to any uſeful purpoſe, has, indeed, ſpent a great deal of time ingeniouſly upon trifles, which might have been more honourably devoted to the good of ſociety, and the exertion of genius. Unintereſting, however, and even detrimental as acquiſitions of this kind may prove, when attained merely for their own ſake, their tendency to promote the purpoſes of uſeful ſcience is indiſputable; and where that tendency is ſeconded by proper induſtry and application, the acquiſitions themſelves muſt riſe proportionally in our eſteem. With propriety, therefore, is Botany divided into two great parts; the firſt, reſpecting the knowledge of the ſeveral parts of vegetables, and their various aſſemblages, as connected by reſemblance, or diſtinguiſhed by contraſt; the ſecond unfolding their properties, virtues and medicinal powers. The relation betwixt theſe parts is mutual and dependent. The latter cannot be acquired without a competent knowledge of the former; the former, though attainable without any ſuch aſſiſtance, derives its utility from its application to the latter.

The reality of this mutual dependance betwixt the two grand objects of botanical knowledge may be inferred from the want of ſucceſs which has accompanied every attempt to diſunite parts ſo cloſely connected. The ancient Botaniſts, particularly Ariſtotle, ſeem to have paid very little attention to the reſemblances on which a diſtinctive knowledge of plants is founded; their aim was, to poſſeſs themſelves of the uſeful part of the ſcience, without encountering its difficulties. The event, however, has ſhewn, that they were egregiouſly miſtaken; and, that, by endeavouring to aſcertain the powers of vegetables, without a previous

vious knowledge of vegetable arrangement, they, in effect, laboured to attain an end, without uſing the proper means to accompliſh it.

Sensible of the inconveniencies to which this error had ſubjected the ſeveral departments in natural hiſtory, the moderns have beſtowed their attention principally on deſcription and ſyſtematic arrangement; and, from an exceſs of refinement, too common in modern times, have hurried into an error of much worſe tendency than that which they laboured to avoid. A nice and ſcrupulous attention to the minutiæ of ſcience is the characteriſtic diſtinction of the preſent age; and in no ſcience is this minutely diſcriminating ſpirit ſo conſpicuous, or ſo detrimental, as in Botany. Not that to diſcover reſemblances, even the moſt trifling, is in itſelf hurtful to ſcience; on the contrary, every ſuch diſcovery, if properly digeſted, is an acceſſion to ſcience. But it is to be feared, that, in proportion as theſe minute reſemblances engroſs the attention, we ſhall loſe ſight of the great object of our purſuit; and, involved in fancy and chimæra, ſtop ſhort at the means, without having either inclination or ability to attain the end. In fine, we ſhall reſt in a bare knowledge of vegetable productions, without applying it to thoſe purpoſes which alone determine its utility.

But from all this it were quite unphiloſophical to conclude that natural hiſtory in general, or botany in particular, is an uſeleſs ſtudy. The very beſt things are liable to be abuſed. But is ſuch an abuſe to be employed as a ſolid argument of their futility and uſeleſſneſs? By no means. The ſame ſcience which has been diſgraced by a butterfly-catcher, or a hunter after cockle-ſhells, is immortalized by the labours of a Bacon, a Boyle, and a Linnæus.

PREJUDICES, however, of this kind, have been entertained; and, becauſe a diſtinctive knowledge of plants muſt neceſſarily precede that of their virtues and medicinal powers, men wrongly imagined that claſſing and arranging plants according to certain minute reſemblances was the ſole buſineſs of the botaniſt. They condemned, therefore, the ſcience as frivolous and uſeleſs, becauſe, perhaps, ſome had ſtopt ſhort in the road, without ſeeking to obtain what ſhould have been the main object of their purſuit.

I FIND I have been inſenſibly led from the advantages that attend the ſtudy of Botany to its difficulties; and of theſe we have already encountered the moſt formidable. Let us take a ſhort view of ſome other circumſtances in the nature of the ſcience which have been found obſtructive of its progreſs.

WHERE the differences are ſtriking, the knowledge of a ſubject is eaſily obtained. Plants are remarkably ſimilar in their form and appearance, and are therefore extremely difficult of inveſtigation.

ADD to this, that the objects about which Botany is converſant are exceedingly numerous and minute. They can therefore only be diſtinguiſhed by minute examination, which few, but thoſe of a curious turn, are diſpoſed to afford them; and hence the progreſs of the ſcience has been at all times ſlow and inconſiderable.

THE confuſion too that has ever prevailed in botanical language, and which is not yet totally removed, has been a mighty impediment to its progreſs; and the great uncertainty in fixing the genera, which Linnæus, the Father of modern Botany, has at length

length accompliſhed, added to the other difficulties already mentioned, muſt have given a beginner a very unfavourable idea of the ſcience he intended to ſtudy.

BEFORE I leave this ſubject, I muſt take the freedom to mention that I am not amongſt the number of thoſe who think that the ſcience has been injured, or rendered more difficult by the great number of methods, or, as they are called, ſyſtems, which have been conſtructed for arranging vegetables. As each of theſe ſyſtems is founded upon the ſtructure of a particular part of the plant, it is evident, the greater number of ſyſtems we are acquainted with, the more knowledge ſhall we have acquired of the different parts upon which ſuch ſyſtems are founded. By an arrangement from the ſtructure of a particular part, as the root, I am led to conſider that part with attention, as it exhibits itſelf, not in a few plants, but through the whole vegetable ſyſtem, when, perhaps, without ſuch a remembrancer, I might be apt to diſregard or overlook it altogether.

HAVING in this manner endeavoured to obviate the principal objections which have been made to the ſcience of Botany, and enumerated the chief difficulties which it has encountered in its progreſs, ariſing almoſt ſolely from an ill-grounded opinion of its being little elſe than a ſimple nomenclature, or, at beſt, calculated merely for amuſement: I ſhould now proceed to direct the reader's attention to the main object of this prefatory VIEW, for exploring which he is now ſufficiently qualified. It will not, however, be improper previouſly to mention the apparatus with which every beginning Botaniſt ought to be furniſhed for the more eaſy and accurate examination of plants; and to that purpoſe I ſhall dedicate the remaining part of this ſection.

THE

THE apparatus in queſtion is as follows:

A SMALL magnifying glaſs for viewing the minute external parts, as thoſe of the flower and fruit. Linnæus's genera, the characters of which are taken from very minute parts, render ſuch a glaſs abſolutely neceſſary.

A SHARP needle for diſſection.

A MICROSCOPE for viewing the internal ſtructure, and thoſe external minutiæ which elude the naked eye.

A BOTANICAL knife.

ON herborizing excurſions into the country, a ſmall tin box for containing ſpecimens of the plants which have occurred in the progreſs. Dillenius was the author of this invention.

IN diſſecting plants, particularly with a view of inveſtigating their ſeveral internal parts, and ſeparating them from one another, maceration in water is neceſſary.

PUTREFACTION too is of ſingular uſe in this reſpect.

WHERE ſpecimens cannot be procured, the botaniſt ſhould have recourſe to the beſt engravings of the ſeveral parts, as Tournefort for the external, Grew for the external and internal parts; Blackwell's herbal, Miller's figures, and *Flora Lapponica*, for the entire plant.

IN the delineating of plants by figures, Columna, Dillenius, Aubriet and Ehret, are eminent. The two former were profeſſed Botaniſts; the two latter artiſts, who, by long experience, became Botaniſts. Such figures, to be perfect, ought to exhibit

all the parts, even the moſt minute. Particular attention is likewiſe to be given to their ſituation and natural ſize.

THE beſt figures on wood are thoſe of Geſner and Rudbeckius; on copper, Ferrarius, Dodart in 1676, Breynius, Commelin, Loeſel, Rheede in 1678, Hermannus, Tournefort in 1694, Vaillant in 1718, Micheli in 1729, Haller in 1742, and Millar the Engraver, in his ſeries of plates explanatory of the Linnæan ſyſtem in 1770; on tin, Dillenius; out-lines without ſhade, Brunsfelſius in 1530, Fuchſius in 1542, Cluſius in 1576, and Father Plumier in 1693, illuminated or coloured after nature, Martin in 1728, Blackwell, Cateſby in 1731, Weinman, Ehret in 1748, Trew in 1750, and Millar in 1770; engraved or impreſſed from the leaves themſelves, Heſſelius's American plants in 1707; and Knipphofius, a German, in 1733.

OF Botaniſts who have written an Univerſal Hiſtory of plants, the moſt eminent are J. Bauhin, Moriſon and Ray. Of partial hiſtories, or the deſcription of a particular claſs of vegetables, are Dillenius's arrangement of the moſſes; Sceuchzer and C. Bauhin's deſcription of the graſſes; Plumier's American ferns; Pomet, Valentine, and Godfrey on the officinal plants.

OF ſuch as have employed their reſearches upon one vegetable only, the principal are, Dillenius on the *ficoides*, or fig-marigold; Boerhaave on the *protea*; Kempfer on tea; Haller on garlic, and the mountain ſpeedwells; Breynius on the famous ginſeng of China; Bradley on the aloe; and Linnæus, in ſome detached pieces in the *Amœnitates Academicæ*; ſuch as the diſſertation upon the dwarf birch, the plantain tree, the fig, paſſion-flower, *lignum colubrinum*, and ſeveral others.

AMONG

Among the enumerations of the indigenous or native vegetables of any particular place or country, or, as they are called, Floras, may be ranked in the firſt place Linnæus's *Flora Suecica*, and *Lapponica*; Haller's *Helvetica*; Ray's and Hudſon's *Anglica*; Magnolius's *Monſpeliaca*; and Gmelin's *Sibirica*.

An enumeration of the plants that are cultivated in any garden, whether public or private, is termed by Botaniſts, *Hortus*. The moſt eminent of theſe are Linnæus's *Hortus Cliffortianus*; Gouan's *Hortus Monſpeliacus*; and in England, lately publiſhed, Hill's *Hortus Kewenſis*, containing a catalogue with ſhort generic characters of the numerous and valuable collection of plants in the botanical area of the gardens at Kew.

Of travels for the improvement of botanical knowledge, the moſt noted are, Sceuchzer's journey over the Alps; that of Calceolarius and Pona to Mount Baldus; Ray's travels and voyages; Tournefort's voyage to the Levant; Adanſon's voyage to Senegal; Gmelin's travels into Siberia; and lately publiſhed, under the auſpices of Linnæus, the travels of Dr. Frederic Haſſelquiſt into the Eaſt, for the purpoſes of advancing natural knowledge. The reader, curious in theſe ſubjects, may likewiſe conſult Proſper Alpinus and Shaw on the plants of Egypt; Sloane and Brown's natural hiſtory of Jamaica; Rheede's plants of Malabar; Hernandez and Feuillé on the plants of Mexico and Peru; and the valuable collection publiſhed by that ingenious traveller, Kempfer, by the title of *Amœnitates Exoticæ*.

The beſt writers on the anatomy and phyſiology of plants, and the vegetable œconomy are, Grew, Malpighi, Duhamel, M. Bonnet, Geſner, Ludwig, and the late learned Dr. Stephen Hales, in his excellent treatiſe, entitled, Vegetable Statics.

The powers of vegetables, and their influence upon the human body, have employed another ſet of writers, as Pomet, in his hiſtory of drugs, and the numerous writers on the *Materia Medica*. Geoffroy and Tournefort have conſidered plants in this light as chemiſts; Porta, Bodenſtein, and Pappen as aſtrologers; Haſſelquiſt and Camerarius as botaniſts.

On the culture of plants, or gardening, the moſt approved Engliſh authors are Bradley in various pieces, and Miller in his Gardener's Dictionary.

For an explanation and application of the ſexual ſyſtem, the reader muſt conſult all Linnæus's books, particularly the *Philoſophia* and *Critica Botanica*; *Sponſalia*, *Genera & Species Plantarum*, and the ſecond volume of the *Syſtema Naturæ*. The firſt-mentioned book contains the rudiments of the ſcience, as new-modelled by Linnæus. The ſecond is a rationale of the new botanical nomenclature; the third contains the arguments for the ſex of plants, with a particular illuſtration of the method founded by the author upon that doctrine. The *Genera Plantarum*, to a tranſlation of which this View of the State of Botany is prefixed, contains exact and compleat deſcriptions of the parts of the flower and fruit, and is an application of the terms reſpecting thoſe parts delivered in the *Philoſophia Botanica*. In examining flowers therefore, with regard to their minute parts, and their ſeveral modifications, the book juſt mentioned muſt be our conſtant companion.

The *Syſtema Naturæ* contains the eſſential characters only of the genera, together with the ſpecific differences, or characteriſtical marks of all the known ſpecies of each genus. This book then begins to be uſeful after a competent knowledge is obtained

obtained of the parts of the flower and fruit by the aſſiſtance of the *Genera Plantarum*, and the object is, not to apply terms, but to explore plants. It is then that by comparing the eſſential or ſtriking characters in the *Syſtema Naturæ* with thoſe of the plant to be diſcovered, we can, with great facility, aſcertain the genus in queſtion; and, by applying the terms uſed to denote the ſpecies, the ſpecies alſo.

As the ſpecies can in this manner be explored by the aſſiſtance of the *Syſtema Naturæ*, the uſe of the book entitled *Species Plantarum*, may ſeem, in ſome ſort, to be ſuperſeded. The fact however is, that the laſt-mentioned work is not ſolely uſeful in detecting the ſpecies of plants: it contains likewiſe the ſynonimous names of the moſt approved authors, together with the place of growth, and duration of each particular ſpecies: and is chiefly calculated for the experienced Botaniſt, whoſe object is not to explore plants, but to obtain as much information as he can from different authors reſpecting the hiſtory of plants already known.

The ſcientific, or technical terms of Botany, as new-modelled by Linnæus, are collected by that author in his *Philoſophia Botanica*, and arranged in a particular order by Johannes Elmgren, a pupil of that celebrated Naturaliſt, in a paper publiſhed in the ſixth volume of the *Amænitates Academicæ*. Theſe terms, by reaſon of their number, and the great confuſion that obtains among them, give no ſmall diſcouragement to the beginning Botaniſt. In a ſcience of ſuch minute inveſtigation as Botany, and where the ſubjects to be examined are ſo remarkably ſimilar, the neceſſity of the utmoſt preciſion is obvious. Till very lately, however, the nomenclature of this ſcience was exceedingly defective in this reſpect. Linnæus has totally reformed the language

guage of Botany, and, indeed, in a great meaſure, introduced a new language into the ſcience. The Linnæan terms, notwithſtanding, are far from being unexceptionable. Of Greek original, they caſt an air of obſcurity, and even myſtery, over a ſcience which, of itſelf, is ſimple and perſpicuous. Many of them too are totally unclaſſical; few convey the meaning readily; not to mention the great number of ſynonimous terms, than which there can be no greater imperfection in ſcientific language. The ſource of this error is to be traced in the bad arrangement or diſpoſition of the terms themſelves. All ſcientific terms are properly divided into general, and ſpecial or particular. Such a diviſion prevents the uſe of ſynonimous terms. General terms I call ſuch as can be applied to all the parts of plants indiſcriminately, and may be arranged under certain modes, as of duration, figure, place, ſituation, ſurface, margin, ſummit. The particular or ſpecial terms are ſuch as apply to a particular part only. Thus, whatever is peculiar to the root, ſtem, or any other part of the plant, is arranged with the ſpecial or particular terms belonging to that part. Whatever applies not only to the root or ſtem, but to all the parts indifferently, is a general term, and arranges accordingly.

The language of Botany being now eſtabliſhed, it is difficult, by the method juſt propoſed, to give a general ſignification to ſuch terms which ſhall apply to every part indifferently. The alteration now offered is rather intended as a ſpecimen of the manner in which the language ought to have been originally conſtructed, than as a perfect reformation of its preſent conſtruction. For as the ſame general term applied to different parts has originally received a different meaning, it is impoſſible, by new-modelling the method or arrangement, to remove that inconvenience,

convenience, unleſs by altering the ſignification of terms, and thus, in effect, inſtituting a new language.

Of the application of each term, the beginner need not be ſollicitous for examples: ſpecimens of the moſt uncommon or remarkable are ſufficient; and frequently a juſt and preciſe explanation will ſuperſede the neceſſity of either ſpecimen or figure.

The laſt auxiliary to the beginning Botaniſt that I ſhall mention, is the uſe of thoſe collections of dried plants, generally known by the name of *Herbaria* and *Horti ſicci*. In collecting plants for this purpoſe, care is to be taken that they are not gathered when moiſt, and that they be kept from moiſture afterwards. They are likewiſe to be compleat in all their parts, even to the minuteſt organ of fructification. The proceſs of drying, and diſpoſing them on paper, is not ſubjected to rules, being entirely directed by the fancy of the collector. Some fix the plants to the paper with glue, others ſtick them into it; and a third ſort faſten them upon it by means of pins. The ſecond method is, in my opinion, preferable; for the glue proves frequently detrimental to the plants, and if diſpoſed by the latter method, they are always apt to drop out. One plant only is to be placed betwixt each ſheet, which ought to have a moderate weight laid upon it, and to be turned at leaſt once in twenty-four hours. When the collection is compleated, or even immediately after it is begun, if agreeable to the collector, the plants are to be arranged according to ſome approved ſyſtem; and the names, both generic and ſpecific, together with ſome circumſtances reſpecting its hiſtory, to be affixed to each ſpecies. Linnæus has deſcribed a cheſt capable of containing ſix thouſand dried plants, in which the diviſions or cells correſpond to the number of claſſes in the

ſexual

ſexual method, and differ in dimenſions according to the greater or leſs number of ſpecies in each claſs.

THE moſt conſiderable collections of this ſort in England are, Dr. Sherard's, which conſiſts of 12000 ſpecies; and Sir Hans Sloane's, now depoſited in the Britiſh Muſæum, which contains 8000. In France, the moſt noted are, that of Tournefort, which contains 4000; that of Vaillant, which contains 12,000 ſpecies and varieties; and thoſe of Juſſieu, and M. Adanſon, which contain each about 10,000 ſpecies and varieties. Theſe are gardens which flouriſh when vegetation is no more, which pleaſe by the ſurprizing variety they diſplay, and are rendered eminently uſeful by the facility with which the natural hiſtory of countries the moſt remote from each other is, by ſuch means, acquired.

SECTION

SECTION III.

Natural and Artificial Methods diſtinguiſhed.

THE terms Syſtem and Method are frequently uſed, without any preciſe idea being affixed to either. Before, therefore, we can pronounce with certainty of the merits of any methodical diſtribution whatever, we muſt remove this ambiguity, and give a determinate meaning to the words in queſtion.

A SYSTEM then is a mode of arrangement by which a number of detached or complicated ideas are reduced to one ſimple and general idea founded upon principles demonſtrated neither to be abſolute nor true, but ſuppoſed ſuch, with a view of conducting to ſome important knowledge, of which we are ignorant. Diametrically oppoſite to this method of compoſition, termed Syntheſis, is that by which a whole is decompounded into its moſt ſimple parts. This mode of reaſoning is ſtiled Analyſis; and the deſcription of thoſe ſimple parts which are its object, Definition. What poſition, or the rule of falſe, is in Arithmetic, Hypotheſis or Syſtem is in Phyſics. In both, the ſuppoſition, which is often manifeſtly falſe, leads in ſome caſes either directly to the truth, or to ſome circumſtance that is ſo connected with it, as to render the diſcovery unavoidable. I ſay, in ſome caſes, becauſe moſt commonly ſuch ſyſtems lead only to conjectures, to paradoxes, and analogies contradicted by the ſenſes.

A METHOD is an arrangement of bodies approximated by ſome agreements or reſemblances in the bodies themſelves. The idea or principle reſulting from theſe agreements, is general, and applicable to all the bodies indiſcriminately; but is never regarded as abſolute, invariable, nor indeed ſo general, as in no caſe whatever to admit of exceptions.

THUS the ſole difference betwixt method and ſyſtem conſiſts in the different idea which the author attaches to his principles, regarding them as variable and leſs general in the former, as abſolute and invariable in the latter. In excellence, therefore, ſyſtem muſt manifeſtly yield to method, from its extreme uncertainty, and tendency to deceive.

IT has been ſaid that a previous knowledge of vegetable arrangement, far from being ſo neceſſary as is pretended, does not even facilitate the knowledge of plants: and a ridiculous diſtinction has been ſuggeſted, whereby to know plants *ſyſtematically*, and to know them *practically*, have been placed in direct oppoſition to each other, as ſubjects, that if not abſolutely incompatible, are, at leaſt, perfectly diſtinct and totally independent. I know but of one caſe, and that not attended to by the authors of this diſtinction, in which it can, with any degree of propriety, be vindicated. The rationale of any ſyſtem, its plan, its principles, may be compleatly acquired, without the previous knowledge of a ſingle plant. I can conceive a novice in what is called the practical part of Botany a compleat maſter of the theory: in ſo far the theory is independent of the practice. But will it be ſeriouſly affirmed that the practice is equally independent of the theory? Or can it be pretended that there is a man to be found thoroughly verſed in plants, and yet totally ignorant of the principles of Botany or ſyſtematic arrangement? What then is the

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practical knowledge of plants ſo much inſiſted on? An application of the principles of arrangement, which, however independent of that knowledge, is only uſeful as it conduces to its advancement. Suppoſe an ignorant nurſery-man, pluming himſelf upon the knowledge he had acquired at ſecond-hand, of the few plants raiſed in his garden from ſeeds which, together with their names, had been tranſmitted to him from different countries, ſhould aſſert the ſuperiority of his practical knowledge, as he would undoubtedly term it, and throw the moſt illiberal invectives on ſcientific principles which he had not capacity to comprehend, I would ſtop his career, by enquiring in what his ſo much boaſted knowledge conſiſted, and whether it was at all communicable to others? To this laſt interrogatory he would doubtleſs reply in the affirmative; and yet the truth is, that ſuch a pretender to ſcience cannot diſtinguiſh between one plant and another, nor of conſequence, communicate to others his cauſe of knowledge. When he ſees a Magnolia, a Kalmia, a Browallia, he remembers the names by which the plants in queſtion have been tranſmitted to him; but it is the names only that he remembers: for aſk him by what invariable marks or characters he recognizes ſuch and ſuch plants, his ſilence as well as ſurprize give conviction of his ignorance. Such is the practical knowledge of plants that is acquired independently of ſyſtematic arrangement!—a knowledge which is neither diſtinctive, nor can be communicated to others, as its cauſe cannot be aſſigned.

Botanists have diſtinguiſhed two kinds of methods, natural and artificial. The excellence of the former has been fully commemorated by almoſt every writer on Botany. Its claſſes or primary diviſions are true natural families founded upon numerous, permanent and ſenſible relations, which are eſſentially the ſame in all the plants of each particular family or aſſemblage.

Thus the whole vegetable kingdom is diſtributed by nature into a ſort of progreſſive ſcale, the claſſes or diviſions of which run inſenſibly into one another, as do likewiſe the ſeveral individuals of each claſs. It is not therefore only the natural families which it imports us to know; we muſt alſo detect the order which nature obſerves in arranging them, and connecting the ſeveral individuals with one another. It is this which makes the diſcovery of that great deſideratum in Botany, a natural method, almoſt impracticable: for whilſt links in the great chain are either miſplaced or deficient; whilſt chaſms remain to be ſupplied; in a word, whilſt a ſingle plant remains undetected, the order of nature muſt ſtill be involved in obſcurity, and our knowledge of the natural tribes that have been already diſtinguiſhed, rendered, in ſome ſort, uſeleſs. Thus the principal impediment to the diſcovery of a natural method, it is only in the power of induſtry, by a proper exertion of its talents in the detection of new ſpecies of plants, to leſſen or totally remove. Animated as I would wiſh every botaniſt by ſo encouraging a circumſtance, I cannot help expreſſing my doubts, that, if detected, ſuch a natural method as that I have been deſcribing, would not greatly facilitate the knowledge of plants. The fact is, that the different genera of each family or tribe are connected by ſuch numerous relations, that, though poſſeſſed of the order of nature, we ſhould be apt to miſtake one genus for another, nay not ſeldom to incorporate all the genera of one natural family into one huge genus. It is in this way that the genera of the lip, pea-bloom, croſs-ſhaped flowers, and ſome other natural orders of plants, are not diſtinguiſhed but with the utmoſt difficulty: an inconvenience which is greatly increaſed from this circumſtance, that the genera in ſuch orders are frequently numerous. When I ſee a ſpecies of ſage, germander, bugle or lavender, the figure and ſituation of the flower, and general habit of the plant immediately determine

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me to refer each to the natural order of lip-flowers, or of plants which flower at the joints: but this is the only thing which I can immediately determine; for upon viewing the numerous liſt of plants which arrange themſelves under that aſſemblage or family, I diſcover ſo many reſemblances and ſo few differences, that I am almoſt tempted to make one enormous genus of the whole, till I reflect that by ſuch proceeding I gain nothing in point of facility, as the trouble thus ſpared by the diminution of genera is more than equalled by the prodigious multiplication of ſpecies. Thus the difficulty of applying a natural method, although, in fact, extreme, is not immediately perceived. For as a plant, by reaſon of ſome conſpicuous character, may be referred almoſt at ſight to its proper claſs or diviſion, we are not apprized of the difficulty, till, upon examining the genera, we find the agreements ſo numerous, and the differences conſequently ſo minute, that diſcrimination ſeems almoſt impoſſible, and we remain as ignorant of the plant to be explored as at firſt. As a proof of this aſſertion, it deſerves to be remarked that thoſe methods which have approached moſt nearly to the natural, either in the plan or execution, have been uniformly found the moſt difficult in practice. Such methods indeed are doubly intricate, becauſe all the claſſes not being ſtrictly natural, it is frequently as difficult to aſcertain the claſs as the genus. Beſides, as the claſſes in ſuch methods muſt neceſſarily be numerous, for the purpoſe of collecting all the natural families, it requires a multiplicity of ſteps to connect them together; and hence the clavis or key of the arrangement is perplexed and intricate. The learned reader, when he hears the names of Moriſon, Ray and Magnolius, quoted upon this occaſion, will agree with me in the fact and in the cauſe which produced it.

As the order of nature is uniform, general and univerſal, that is, admits of no exception, but being totally independent of our will, is regulated by the nature of things, which conſiſts in the combination of all their parts and qualities; it is evident that there can be no natural method in Botany but that which ariſes from a combined view of all the parts of plants, and their relations. Into this view muſt enter the roots, ſtems, leaves, flowers, fruit, general habit; in fine, all the parts, qualities, properties and faculties of plants. From the ſymmetry of theſe parts, from their figure, number, ſituation and reſpective proportion, and from a compariſon of their qualities, agreements and differences, ariſes that affinity which approximates plants, and diſtinguiſhes them into natural Claſſes or Families. This idea, however, of a natural method, though moſt certainly the true one, is very different from that of Linnæus, who, diſregarding the habit or external port, and ſeveral other circumſtances juſt mentioned, confines himſelf merely to the ſymmetry of all the parts of fructification.

An artificial method collects genera which do not poſſeſs the greateſt number of relations neceſſary for approximating them to one another, although they agree in the characteriſtic mark or marks aſſigned to each claſs. From this definition it is evident that the characters employed in artificial methods, becauſe leſs numerous, are ſimpler than thoſe employed in the natural method. For the ſame reaſon, ſuch methods are infinitely more eaſy; becauſe the genera of each claſs not being connected by ſuch numerous relations, are eaſily diſtinguiſhed from one another: and the claſſic character generally depending upon a ſingle circumſtance, the claſſes, which, in moſt artificial methods are proportionably few in number, may be aſcertained with equal facility. As nature is uniform in all her operations, there can be but

but one natural method; whereas the number of artificial methods is almoſt inexhauſtible, ariſing from the combination of the different parts of plants, their figure, number, proportion, ſituation and other circumſtances.

I CANNOT better illuſtrate the difference, in point of facility, between natural and artificial methods than by reminding the reader of the two different ways of arranging words in a dictionary. The moſt natural method of arranging words would doubtleſs be to place all derivatives under their primitive, and all compounded words under their ſimple root. Such rational dictionaries, however, would be by no means uſeful to learners, nor anſwer the purpoſe that nomenclatures of this kind are intended to ſerve. Artificial dictionaries therefore were invented, in conſtructing which, no ſort of knowledge whatever was preſuppoſed in the beginner, ſave that of the order of the alphabet merely. A boy who knows his letters, and the order of their ſucceſſion, can turn up any word you dictate full as quickly as if compleat maſter of its derivation and etymology. There is no ſcience required. It is an eaſy ſuccedaneum for the rational dictionary juſt mentioned, which, however excellent, could only be uſeful to the learned, to whom the derivations and compoſitions of words are familiar. Artificial methods are to the natural, what the alphabetical dictionary is to the etymological. The characteriſtical marks of the claſſes correſpond to the letters of the alphabet, and the order of their ſucceſſion: the natural families and the order of their arrangement, to the etymological arrangement of words. The analogy is ſtrong; and the difference, in point of facility, may be explained, in both caſes, on the ſame principles.

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FROM the definition delivered in the beginning of this ſection, it is evident, that every ſyſtem muſt be artificial, becauſe its principles are ſuppoſed to be abſolute and true, but not demonſtrated ſuch. Theſe ſuppoſitions may indeed ſometimes be realized in the ſequel, and demonſtrated to be true: in which caſe they ceaſe to be ſyſtematic principles, and become part of the natural order of things. It was this which happened to the planetary ſyſtem of Copernicus, when a ſufficient number of obſervations had confirmed beyond a doubt the relative diſpoſition in the orbs of the ſolar planets, which that ſyſtem had ſet out with ſuppoſing.

SYSTEMATIC Botaniſts are divided by Linnæus into two claſſes, termed *Orthodox* and *Heterodox*. The former have arranged plants by a method founded on ſome part of the flower or fruit: I ſay, on ſome part, becauſe the choice is arbitrary, though ſome of the parts are manifeſtly preferable to others. Heterodox Botaniſts are ſuch as have diſtributed plants from ſome part or circumſtance unconnected with fructification. Such were moſt of the writers during the rude ſtate of the ſcience: ſuch even are ſome modern authors of eminence, as Sauvage and Duhamel, who have ſuggeſted an arrangement from the leaves; and Miller, who leſs philoſophically ſtill, has digeſted the plants he deſcribes in alphabetical order. The numerous methods founded on the external habit or port, the time of flowering, place of growth, medicinal powers and ſome other circumſtances, are equally contrary to the genuine orthodox principles of ſyſtematic arrangement with thoſe of the authors juſt mentioned. The firſt orthodox Botaniſt was Cæſalpinus, a profeſſor at Padua, who, in 1583, gave riſe to the ſyſtematic æra of Botany, by the publication of an arrangement of plants founded upon the fruit, the idea of which he had received

ceived in 1560, from Conrad Geſner, an eminent phyſician of Switzerland.

As the following ſection will be ſolely employed in tracing the progreſs of method from its firſt and ſimpleſt rudiments in botanical writings to its preſent more improved ſtate, it would be improper to enlarge farther in this place upon the diſtinction which has juſt been ſuggeſted. I ſhall therefore diſmiſs this ſection with an explanation of the terms Univerſal, General and Partial Methods which frequently occur in diſſertations on botanical ſubjects.

An univerſal method is that which includes all the plants known at the time of its eſtabliſhment. Of this kind are the methods of Bauhin, Ray, Tournefort, Linnæus and many others.

A general method is converſant, like the former, about all the different claſſes of plants, but limits its reſearches to a particular ſpot, region or country, without including all known plants. Of this kind are thoſe enumerations of the native vegetables of any particular place or country, generally known by the name of Floras. Theſe catalogues, for they are no other, have multiplied exceedingly of late years; and it requires only a very ſlight acquaintance with the ſubject to divine the cauſe. When books can be made with ſo very little trouble as tranſcribing occaſions, all the world may turn authors. The catalogues in queſtion have certainly their uſe, and, in proper hands, might prove of eminent advantage, by being enriched with many valuable obſervations reſpecting the natural hiſtory of the ſeveral countries and provinces whoſe plants they enumerate. But at preſent they are little elſe than mere tranſcriptions from the *Species Plantarum* of the generic, ſpecific and ſynonimous names of

plants, with ſcarce a ſingle remark worth attention, or one deviation from the beaten path, which might diſplay ingenuity. The evil of this is, that illiterate people, tempted by the facility of ſuch an undertaking, may commence authors, and wading beyond their depth, contribute as effectually to miſlead the public, through vanity, as others through deſign. From this cenſure I would particularly exempt the ingenious M. Gouan, who both in his enumeration of the plants which grow naturally around Montpelier, and in his catalogue of the indigenous and exotic plants that are reared in the botanical garden at that place, has uſefully deviated from the common track, and, among ſeveral other intereſting particulars, prefixed to each genus its ſecondary characters, or thoſe derived from the habit and general appearance of the plants which compoſe it.

PARTIAL or particular methods are limited to the examination of a ſingle claſs of plants. Such are Vaillant and Pontedera's arrangement of the compound flowers; Moriſon and Artedi's diviſion of the umbelliferous plants; Ray, Monti, Scheuchzer, and Micheli's arrangement of the graſſes; thoſe of the moſſes, muſhrooms and flags by the laſt mentioned author, Dillenius, Gleditſch and Battarra.

SECTION IV.

The progreſs of Method and Syſtematic Arrangement from its ſimpleſt Rudiments in Botanical Writings.

THE diſtinction of Heterodox and Orthodox Botaniſts, ſuggeſted in the cloſe of the laſt ſection, ſerves very properly as a foundation for the method to be obſerved in this. The firſt writers on plants, ſtudious to render Botany uſeful, were little ſolicitous about means to facilitate its knowledge. They collected the names of plants, their virtues, and œconomical uſes, and made what additions they could to the ſcanty original liſt. Mean while, arrangement lay either totally neglected, or, founded upon inſufficient principles, was little calculated to inſtruct. The period during which Botany continued in this uncultivated imperfect ſtate, I have choſen to deſign by the name of the Hiſtorical Æra; becauſe the knowledge which it inculcated, being confined to the names, number and virtues of plants, was profeſſedly of the hiſtorical kind. The other æra, which commences with Cæſalpinus, is properly denominated the Syſtematic Æra of the Science, from the orthodoxy of its methods, and genuine purity of the principles on which they proceed.

THE Hiſtorical Æra opens with Theophraſtus, who is very properly conſidered as the Father of Botany. For although, prior to the time of that elegant Naturaliſt, ſeveral writers are ſaid to have mentioned plants occaſionally, and even to have given deſcriptions of them; yet ſuch deſcriptions are either looſe and deſultory,

ſultory, or have periſhed with the works in which they were contained. In this light we are to regard the writings of Zoroaſter the Perſian; thoſe of Orpheus, Muſæus, Heſiod, Homer, Solon, Pythagoras, Cratevas, and Hippocrates among the Greeks; and among the Jews, thoſe of Moſes and Solomon, the laſt of whom is ſaid "to have ſpoken of trees from the cedar that is "in Lebanon, even unto the hyſſop that ſpringeth out of the "wall." The greateſt part too of Ariſtotle's two books on plants, which are frequently quoted by himſelf, has periſhed in the general wreck of time; and the little that has eſcaped its undiſtinguiſhing fury has been ſo mangled and torn by the unſkilful, under the ſpecious pretext of ſupplying its defects, that we have only to lament, that the original work was not either totally preſerved, or totally loſt.

THEOPHRASTUS, the diſciple of Ariſtotle, was born at Ereſium in the iſland of Leſbos, and flouriſhed in the third century before the Chriſtian æra, being about 100 years poſterior to Hippocrates. His work, entitled the Hiſtory of Plants, is executed in a truly philoſophical manner. It treats of vegetation, of the origin and propagation of plants, of their anatomy and conſtruction, and of vegetable life. In a diſſertation of this nature, profeſſedly confined to the philoſophy of plants, it would be highly abſurd to expect a numerous catalogue, or a ſtudied well-digeſted plan of arrangement. The number of plants which his ſubject led him to deſcribe or mention amounts to about five hundred. Theſe he has arranged by a method, which, however unſyſtematical, ſeems extremely well ſuited to the rude ſtate of the ſcience, and was indeed partly ſuggeſted by his main ſubject. The work in queſtion originally conſiſted of ten books, one of which is loſt. In the remaining nine, vegetables are diſtributed into ſeven claſſes or primary diviſions, which have for their object the generation

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of plants, their place of growth, their ſize, as trees, and ſhrubs; their uſe, as pot-herbs and eſculent grains; and their lacteſcence; which laſt circumſtance reſpects every kind of liquor, of whatever colour, that flows in great abundance from plants, when cut. In this ſhort view of Theophraſtus's Hiſtory of Plants, I have confined myſelf merely to his method of arrangement. As a philoſophical treatiſe on the laws of vegetation, its eminence is indiſputable. The diction is remarkably elegant, and withal ſo perſpicuous and eaſy, that a ſtrict peruſal of the original cannot be too warmly recommended to botaniſts who have ſtudied the Greek language; I ſay, the original, becauſe there are many inaccuracies and errors in the beſt tranſlations, owing to an ignorance in the tranſlator of the terms of botany.

The next Botaniſt of note was Dioſcorides, by birth a Grecian, but under the Roman empire. The number of known plants, their virtues, and the names by which they were diſtinguiſhed both in Greece and the adjacent countries chiefly employed the attention of this indefatigable botaniſt. That the ſcience, however, was ſtill in its infancy, appears from this remarkable circumſtance, that, although near four hundred years poſterior to Theophraſtus, and profeſſedly a collector, Dioſcorides has not been able to enumerate above ſix hundred plants, five hundred of which were deſcribed or mentioned by the Father of Botany. In the writings of Dioſcorides we do not recognize that elegance of diction and thoſe graces of manner which characterize his predeceſſor. His ſtyle is ſimple, plain and devoid of ornament. The deſcriptions, nevertheleſs, although imperfect, are preferable to thoſe of the other, becauſe the characters which they collect are more numerous and invariable. Plants were arranged, by this author, from their uſes in medicine and domeſtic œconomy, into four claſſes, which are thus deſigned; Aromatics, Alimentary Vege-

Vegetables, or ſuch as ſerve for food; Medicinal and Vinous Plants. To obſerve on the impropriety of ſuch a mode of arrangement, is altogether unneceſſary. In fact, the qualities and virtues of plants can never afford genuine diſtinctive marks, becauſe neither fixed and invariable, nor impreſſed in legible characters upon the bodies themſelves. The different parts too of a plant often poſſeſs different and even oppoſite virtues; ſo that, ſuppoſing ſuch virtues to be known, and to be miſapplied to the purpoſe of vegetable arrangement, the root muſt frequently fall under one diviſion, the leaf under a ſecond, the flower and fruit under a third. Beſides, if we reflect that the ſole end of ſuch arrangement is to facilitate to others the knowledge of plants, the inſufficiency and even abſurdity of methods founded upon their virtues will quickly appear. A ſtalk of vervain is preſented to me, which I am to inveſtigate by a method that has the virtues of plants for its principle. How am I to proceed? Before I can ſettle the claſs under which it is arranged, I muſt diſcover its virtue; and ſuch diſcovery being the reſult of repeated experiments on various parts of the human body, may require years for its accompliſhment. Thus ſuch methods of diſtribution are totally uſeleſs in inveſtigating plants, and therefore highly improper to be employed. A genuine diſtinctive character founded on the external parts, which a little inſtruction ſoon renders familiar, will cut ſhort this work of years, and determine almoſt at ſight the claſs, genus and ſpecies of the plant in queſtion. In the firſt caſe there is no principle whatever upon which to proceed; in the ſecond the ground is ſure, becauſe the external parts are always preſent, and always obvious to ſight. The ſtructure of the root, ſtem, leaves, flower and fruit, is an object of ſight, and can always be recognized: the virtues and medicinal powers of plants afford no diſtinctive character, and cannot be recognized without a ſeries of experiments made expreſsly with that view.

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It deſerves likewiſe to be remarked, that the virtues of plants employed in medicine have been much better aſcertained ſince the introduction of genuine ſyſtematic arrangements than at any former period: and it is more than probable that the nearer we approach the order of nature, with greater certainty and facility ſhall thoſe virtues be detected. The powers and ſenſible qualities of a ſingle plant of any of the natural families being diſcovered, thoſe of the reſt no longer remain concealed; as ſo many circumſtances of reſemblance in the external ſtructure may well induce ſomething more than conjecture that their qualities and effects upon the human body cannot be very diſſimilar. And, indeed, it is its extreme importance to phyſic, that renders the diſcovery of a natural method in Botany, ſo deſirable an object: conſidered merely as an arrangement, whoſe chief object is to facilitate the knowledge of plants, it muſt yield the preference to many of the artificial methods already known. This is demonſtrated at large in the preceding ſection.

The ſame cauſes which render methods founded on the virtues of plants, unfavourable for the purpoſe of inveſtigation, muſt evidently diſqualify all their other variable qualities and accidents from holding a place in a genuine diſtinctive ſyſtematic arrangement, The *natale ſolum* of plants, which is one of Theophraſtus's diviſions, affords no more a diſtinctive character than their powers and virtues. Many countries, as well as many ſoils, produce the ſame individual plants. The ſame ſpecies which crown the mountains, frequently cover the fens: and plants which have long been reckoned the peculiar inhabitants of ſome parts of Aſia and America, are now found to grow naturally in equal perfection in the very different climates of Lapland and Siberia. In fine, however uſeful the natural ſoil and climate of plants may

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be in gardening, they are circumſtances of no utility whatever, when employed as the foundation of a mode of arrangement.

The ſize of plants, which ſuggeſted the ancient diviſion into trees and ſhrubs, is no leſs an equivocal mark of diſtinction than the circumſtances already mentioned. The vine, which modern botaniſts denominate a ſhrub, was ranged by Theophraſtus in his third claſs, containing trees. In fact, every thing reſpecting ſize is ſo much affected by differences of ſoil, climate and culture, that the ſame plant, in different circumſtances, ſhall differ exceedingly in height, and, in a method founded upon that accident, be arranged ſometimes as a tree, ſometimes as a ſhrub, and ſometimes even as an under-ſhrub, according as it exceeds, equals, or falls ſhort of a given ſtandard.

No leſs inſufficient and deſpicable are characteriſtical marks drawn from the ſenſible qualities of plants; I mean their colour, taſte and ſmell.

Of all the attributes of vegetable nature, colour is perhaps the moſt inconſtant. Heat, climate, culture, ſoil, and a thouſand circumſtances contribute to produce almoſt endleſs diverſities in that quality, and render the tranſition from one colour to another natural and eaſy. Red and blue paſs eaſily into white; white into purple; yellow into white; red into blue; blue into yellow. In the ſame leaf or flower are frequently obſerved ſeveral different colours. Variations too in point of colour are often found to take place, not only in different individuals of the ſame ſpecies, but likewiſe in ſimilar parts of the ſame individual plant. Marvel of Peru and Sweet William produce flowers of different colour upon the ſame ſtalk.

OBJECTIONS equally valid lie againſt taſte and ſmell. The former varies in different individuals from differences of age; and even in the ſame individual, at different times, according to the morbid or ſound ſtate of the organ. The latter is different in different ſubjects, and varies in each. The effluvia ſent forth from the ſame body are not always of equal intenſity; which is the reaſon that dogs diſcover their maſters in a crowd with much greater facility at one time than another. In plants, taſte is ſubjected to continual variations from differences of climate, ſoil, and culture. Garlic, in ſome climates, particularly in Greece, is ſaid to loſe its rankneſs; apples and pears that grow naturally in the woods are intolerably acid; celery and lettuce, which culture renders ſweet and palatable, are, in their wild uncultivated ſtate, bitter, diſagreeable, and, in ſome caſes, noxious.

ALMOST cotemporary with Dioſcorides flouriſhed Antonius Muſa, Cato, Varro, Virgil, and Columella; the firſt, author of a treatiſe ſtill extant on the plant betony; the four others celebrated for their uſeful tracts on agriculture and the œconomy of rural affairs.

PLINY the elder, who is generally reckoned poſterior to Dioſcorides, ſcarce merits a place in a review of this kind. His work, entitled a Hiſtory of the World, is a compilation from the writings of all his predeceſſors in every branch of natural knowledge. The botanical part of this voluminous undertaking is included in fifteen books, which, beſides the plants of Theophraſtus and Dioſcorides, contain deſcriptions of ſeveral new ſpecies, extracted, in all probability, from works which would have been totally loſt, but for the laudable induſtry of this indefatigable compiler. Pliny uſes ſcarce any mode of arrangement, ſave the very incorrect, though ancient, diſtinction into trees,

ſhrubs and herbs. His ſubjects are exceedingly multifarious, and extend, not merely to botanical diſtinctions, but to gardening, agriculture, and whatever is connected either more nearly or remotely with the ſcience of plants. In an immenſe compilation of this kind from authors of very different merit and credibility, we are not to be ſurprized, if all the facts are not equally authentic, nay, if ſome are abſolutely contradictory. Upon the whole, Pliny, although no botaniſt, is a valuable and uſeful writer. His book contains all the natural hiſtory of the ancients delivered in a ſtile that is not devoid of ornament: and the botanical part, however badly arranged, gives deſcriptions or names of upwards of a thouſand ſpecies of plants: ſo that about four hundred ſpecies are mentioned by Pliny which are not to be found in the writings of Dioſcorides; an increaſe which ſeems amazing, when it is conſidered, that the interval betwixt the Greek and the Roman could not have exceeded thirty years.

As it is the profeſſed deſign of this ſection to relate the hiſtory, not of botaniſts, but of botanical methods, I paſs over with a bare mention the names of ſome Romans and Aſiatic Greeks, whom I find recorded in this æra of the ſcience as perſons addicted to the ſtudy of plants, but totally inattentive to the laws of vegetable arrangement. In this light we are to regard the writings of Rufus under Trajan, and thoſe of Palladius under the emperor Antonius Pius. About the middle of the ſecond century appeared Galen, a name not more celebrated in phyſic than inſignificant in Botany. The virtues and medicinal powers of bodies, whether animal, vegetable or mineral, were the favourite reſearch of this author. To this great object he rendered every thing ſubſervient, regarding as uſeleſs whatever was not profeſſedly calculated to promote that end. Thus the Botany of Galen, however uſeful to the ſtudent of Pharmacy, is inſufficient for

for inveſtigating a ſingle plant. It ſuppoſes every thing, it teaches nothing. Oribaſius, another Aſiatic Greek, trod in the path marked out for him by his maſter Galen, but with ſo little ſucceſs, that ſcarce a fourth part of the plants of Pliny was known to this author. To him ſucceeded Aetius Amydenus, Paulus Ægineta, and Alexander Trallian: the two firſt compilers; the latter a man of a more free and liberal turn: but the ſcience was in diſrepute, and not even a Trallian could revive its drooping head.

The limited Botany of the ancients, and its rapid decline from the time of Pliny to that of the authors juſt mentioned, can only be attributed to a neglect of ſyſtematic arrangement, which, in facilitating the knowledge of plants, prepares for an inveſtigation of their powers and virtues. It was not till near the cloſe of the eighth century, that the Cimmerian darkneſs which had diffuſed itſelf over this ſcience began to diſſipate, and Botany, as well as the other departments of natural knowledge, re-aſſumed its priſtine form. The ſcene of this firſt reſtoration of the ancient Botany, lies in Arabia. Serapio, a well-known name in medicine, ſtands firſt in the Arabian catalogue; to him ſucceeded Razis, the laborious Avicenna, Averrhoës, Actuarius and other names leſs celebrated. Their works, however, are only tranſlations and compilations from the Greek writers. The genuine ſpirit of arrangement had not yet obtained. Unable therefore to ſupport itſelf long, the ſcience ſunk into a ſecond oblivion; and the few faint glimmerings which chance had juſt afforded, ſerved only to make the ſubſequent darkneſs appear more horrible.

During the ages emphatically ſtiled Barbarous, the human mind may be ſaid to have ſuffered a ſort of temporary annihila-

tion. Literature languiſhed. Science was no more. In this ſtate of univerſal torpor, not to be paralleled in the hiſtory of mankind, Botany, we may well ſuppoſe, ſhared the general fate, and lay neglected with every other uſeful art. For four hundred years poſterior to Abenguefit, an Arabian phyſician who flouriſhed in the latter end of the twelfth century, ſcarce any attempts were made to draw from its obſcurity the Botany of the ancients, far leſs to extend its boundaries, by new reſearches. True it is, the hiſtory of the ſcience commemorates the names of a Myrepſus, a Hildegardis, a Quiricius, a Platearius and a Sylvaticus, who, during the prevalence of barbariſm, made ſome faint efforts to emerge from the general ignorance: but, unequal to the arduous taſk, they ſunk under the mighty load; and the ſame obſcurity has involved them and their works. Little more reverence is due to the names of Cuba, De Dondis, Suardus, Boſco, Villa Nova, and Creſcentius, who lived in the fourteenth and fifteenth centuries, and are generally ranked among the number of botanical writers. They wrote of plants indeed; but they wrote of them without method, without language, without knowledge. All was one great chaos; and conſummate indeed would have been the labour of that man who could reduce ſuch a maſs of confuſion into ſymmetry and order.

On the revival of letters in the beginning of the ſixteenth century, the Botany of the ancients was reſtored a ſecond time. The Greek writings were tranſlated into Latin, the common language of Europe; and the ſpirit of free enquiry once more prevailed. Gaza, a Greek refugee at Rome, made elegant tranſlations of Ariſtotle and Theophraſtus, who, in the ſequel, were commented on by Scaliger and Stapel. Dioſcorides was tranſlated, firſt by Cornarus in 1557, and afterwards by Sarrazin in 1598. His beſt commentators are Hermolaus Barbarus, Fuchſius,

ſius, Ruellius an ingenious Frenchman, Cordus, Geſner, and Matthiolus. The moſt diſtinguiſhed commentators of Pliny are, Dalechamp in 1604, Saumaiſe or Salmaſius in 1689, Harduin and Guilandinus. Meurſius and Urſinus have written commentaries upon Cato; Campegius and Monardes upon Meſue the Arabian, and Lonicer upon Avicenna, who has been tranſlated by ſeveral writers, particularly Alpagus, Coſtæus, Plempius, into Latin; and by one writer, Amalthæus, into Hebrew.

Hieronymus Bock, or Bouc, a German, generally known by the name of Tragus, is the firſt of the moderns who has given a methodical diſtribution of vegetables. In his Hiſtory of Plants, publiſhed in 1532, he divides the 800 ſpecies there deſcribed into three claſſes, founded on the qualities of vegetables, their habit, figure and ſize. The diſtinctions of Lonicer, Dodonæus, L'Obel, Cluſius, Brunfelſius, Monardes, Cordus and ſome other Botaniſts of this period were not more ſcientifical, and reſpected either the medicinal powers of plants, their ſenſible qualities, œconomical uſes, or ſome of the external parts not connected with the flower and fruit. The inſufficiency of leading characters from the virtues, accidents and variable qualities of plants has been fully demonſtrated in the preceding part of this ſection. A certain degree of excellence is poſſeſſed by every method, which derives its diſtinctive characters from any of the external parts: but that excellence is merely comparative, being, in different methods, greater or leſs, as the parts, by their ſtructure and modifications, ſeem more or leſs adapted for the purpoſe of vegetable arrangement. Characteriſtical marks drawn from the root, ſtem or leaves, are ſuperior to thoſe derived from the virtues and qualities of plants, becauſe obvious to ſight, and capable of being recognized in the bodies themſelves. But characters drawn from the flower and fruit being more uniform and invariable, and

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therefore of far greater utility in facilitating the knowledge of plants, are ſuperior, in point of excellence, to thoſe derived from the other parts.

The roots and ſtems of plants do not furniſh ſufficient variety of characters to ſerve as foundations of a mode of arrangement. Botaniſts have been able to diſtinguiſh but three ſorts of roots, *fibrous*, *tuberous*, *bulbous*, and their modifications. With ſo few diſtinctive characters, what method could be uſeful? For although by means of ſuch diſtinctions alone the claſs of any plant can be immediately detected, it is next to impoſſible that the genus ever ſhould: Why? becauſe the claſſes, for want of diſtinctive characters, being few in number, would be ſo overloaded with genera, that a combination of all the parts of the plant, and their ſeveral modifications would not ſuffice to diſcriminate them. It deſerves likewiſe to be remarked, that the root, by being hid under ground, ſeems of all the external parts, the moſt improper for the purpoſe of vegetable arrangement. What could be more inconſiderate than to make our knowledge of any plant depend upon a circumſtance which muſt always injure, and, in many caſes effectually deſtroy it? The trouble too of pulling up plants by the root in order to determine their preciſe place in the arrangement, muſt have proved extremely irkſome to the botaniſt, and well nigh compelled him to relinquiſh a ſcience, ſo difficult in the attainment. For theſe reaſons, no method that I am acquainted with, claims the roots of plants, and their different modifications for its ſole principle: I ſay its ſole principle, becauſe there are ſome methods, and thoſe ſince the introduction of ſyſtematic arrangements, in which the form of the root is made a characteriſtic diſtinction for diſcriminating a few of the claſſes only. Equally improper for the purpoſe of arrangement, becauſe not more numerous, are the forms and modifications of the ſtem. In

trees,

trees, it is hard and woody; in herbs, ſucculent; in the graſſes, hollow and jointed; in the ferns and palms, a ramified leaf, or rather a ſingular compoſition of a leaf and branch. Theſe are almoſt the only diſtinctions ariſing from the form of the ſtem: unleſs we add, that its figure, generally cylindrical, is, in ſome plants, angular; and that, in others, it is found to elevate the flower and fruit only, without the leaves.

The duration of the ſtems of plants ſuggeſted the ancient diſtinction into herbs and trees; the former, vegetables of a leſs ſolid conſiſtence, which loſe their ſtems during the winter; the latter of a firm, ſolid texture, woody, and ſubſiſt, by their ſtems, during the winter. Theſe laſt were ſubdivided by Ariſtotle and Theophraſtus, and afterwards by Cluſius in 1576, into Trees properly ſo called, Shrubs and Under-ſhrubs. Under-ſhrubs are defined to be perennial plants with a woody durable ſtem, whoſe height exceeds not that of herbaceous vegetables. Shrubs differ from theſe only in their ſuperior ſize. Trees properly ſo called are perennial woody plants, which riſe to a very great height, and ſubſiſt for many years. Such is the diſtinction of L'Ecluſe; but it is far from being accurate, and, conſidered as the foundation of a mode of arrangement, has been proved inſufficient. Neither are thoſe to be regarded, who, in order to diſcriminate woody plants, have recourſe to the number of ſtems, combined with their ſize, and underſtand by trees, all ſuch vegetables as are of great height, and riſe with a ſingle ſtem; by ſhrubs, ſuch as riſe with ſeveral ſtems; and by under-ſhrubs, ſuch as have only a ſingle ſtem, that riſes to a very ſmall height. The character aſcribed by ſuch authors to ſhrubs falls oftener to the ſhare of thoſe plants denominated under-ſhrubs; for although ſhrubby plants ramify and divide much nearer the ground than trees, yet are they very rarely known to proceed from the roots with more than a ſingle

a ſingle ſtem. Linnæus has not been more ſucceſsful with his diſtinction from the buds: for if by trees we were to underſtand ſuch woody plants as riſe with buds; and by ſhrubs, ſuch as have no buds, the very large trees of India, which rarely bear any gems, would, notwithſtanding their great height, be denominated ſhrubs, and arranged accordingly. The truth is, that nature ſeems to have put no abſolute limits between trees and ſhrubs; ſo that a definition cannot be given of the one, which ſhall not, in ſome ſort, include the other. Thus, trees, ſhrubs, under-ſhrubs and herbs form a kind of ſcale, the degrees of which, like thoſe of the ſcale of beings imagined by ſome Naturaliſts, run inſenſibly into each other, and elude diſtinction. It is only, however, in the mean terms of this ſeries that we are to expect any ſuch inſenſible gradations. The extremes are perfectly diſtinct, and can never be confounded. But though I allow the diſtinction of herbs and trees to be ſufficiently aſcertained, I am far from thinking it proper to be employed as a diſcriminating claſſical character. If uſed alone, it is too general to be of any ſervice whatever: if in conjunction with other characters, it deſtroys the uniformity of the method. In the former caſe, the number of claſſes is reduced to two; in the latter, there is an unneceſſary multiplication of claſſes, becauſe the ſame characters which diſcriminate herbs, ſerve frequently to diſcriminate trees alſo. M. Tournefort, by adopting this diſtinction, has deſtroyed the uniformity of his plan, and ſpun out into twenty-two claſſes what, without ſuch diſtinction, might have eaſily been comprized in ſeventeen. Want of uniformity, however, aſide, there are other reaſons which render the duration of plants an inſufficient and improper diſtinction. In many caſes, we cannot determine at ſight whether a particular plant is of the herbaceous or woody kind; in the ſame manner as the ſize of plants, allowing it to be a ſufficient character, could never diſtinguiſh trees from ſhrubs, till each had

had attained its full and proper height. Young trees and ſhrubs are not leſs tender and ſucculent than herbs; ſo that an entire revolution of the ſeaſons muſt frequently elapſe before we can be apprized of their genuine nature. On the other hand, many herbaceous plants appear of a hard, ſolid conſiſtence like ſhrubs; and to mention no more, there are inſtances of plants which, from being trees in a warm climate, have become herbs, by being removed into a cold one.

As the duration of the ſtem ſerves to diſcriminate trees from herbs, the duration of the root diſtinguiſhes the ſeveral kinds of herbaceous vegetables from one another. Herbs which riſe, grow and die in one year, are termed Annuals; thoſe which perform the changes of vegetation twice, Biennials; and thoſe which ſubſiſt ſeveral years by the root, Perennials. Trees and ſhrubs differ from perennial herbs in that they ſubſiſt both by the root and ſtem.

The leaves, although much more diverſified in their form than either the root or ſtem, are equally improper for diſcriminating the claſſes of plants. Saſſafras, and paper-bearing mulberry bear leaves, ſome of which are perfectly entire, others cut either ſlightly or deeply into one, two or three lobes. In triple-thorned Acacia the leaves are partly winged, partly double-winged, partly ſimple. Innumerable are the accidents which produce varieties in the form and ſituation of leaves, and render ſuch circumſtances highly improper to be employed as ſcientific diſtinctions. The ſame plant, in different climates, with different culture, or ſowed at different ſeaſons of the year, is covered with leaves that are totally diſſimilar. Plants, otherwiſe nearly related, are found to produce leaves, between which there is no ſort of reſemblance: and others which differ eſſentially in figure, qualities and habit,

bear leaves ſo remarkably ſimilar, that confuſion would be unavoidable, if primary diviſions were to be erected upon ſo unſtable a foundation. Neither is the ſituation of leaves, I mean their diſpoſition on the ſtem and branches, however comparatively fixed, abſolutely immutable. In a ſpecies of looſe-ſtrife, the leaves, which generally ſtand oppoſite in pairs, are occaſionally produced by threes, fours and fives round the ſtem. An addition of the like kind is frequently made to the number of partial or leſſer leaves, which conſtitute a compound leaf. In a ſpecies of trefoil, the leſſer leaves in queſtion, generally three in number, are occaſionally augmented to four.

THE root, ſtem and leaves being thus found ſingly inſufficient, leading characters were ſought in a combination of thoſe and the other eſſential parts of vegetation. This combination, denominated the port or habit, has been no more ſucceſsful, as the foundation of an arrangement, than the circumſtances already mentioned. In detecting the order of nature, ſuch a combination muſt undoubtedly be employed: in arranging plants with a view to facilitate their knowledge, it is highly improper, becauſe complicated, and deſtructive of uniformity. In fine, characters drawn from the habit or general appearance, however uſeful in diſtinguiſhing genera and ſpecies, are, in my opinion, never to be employed as claſſical diſtinctions.

SUCH was the progreſs of botanical method, when Conrad Geſner turned his eye to the flower and fruit, and ſuggeſted the firſt idea of a ſyſtematic arrangement. This ingenious Naturaliſt, who imbibed his knowledge of plants in the mountains of Switzerland, was early ſenſible of the impropriety of every plan of arrangement which had been adopted. The claſſical characters of each method underwent a particular review: and all, from

defects

defects peculiar to each, were found liable to cenſure. In this comparative trial of the aptneſs of the ſeveral external parts for the purpoſe of arrangement, it appeared wonderful to Geſner that none of the numerous writers on plants had availed themſelves of the parts of fructification, which, from their great variety, ſuperior conſtancy, and extreme importance in perpetuating the ſpecies, ſeemed to merit the preference above every other claſſical diſtinction. That Geſner knew the doctrine of the ſexes, which ſuppoſes the moſt intimate connection between the flower and fruit, I do not pretend to affirm: but he certainly knew that the fruit was uſeful in re-producing the plant, and that it always ſucceeded the flower. Thus a connection, if not ſo intimate, at leaſt, as indiſſoluble, was eſtabliſhed; and the parts of the flower and fruit were named in conjunction. By the flower was underſtood that fine, ornamental and beautifully coloured part of the plant, which falls off or withers ſoon after its expanſion, and immediately precedes the fruit, to which it generally adheres. This definition, although it principally reſpects the petals or coloured leaves, includes likewiſe the calix or flower-cup; the ſtamina, chives or threads; and the piſtil or pointal-parts which, in the infancy of ſyſtem, were not deemed of ſufficient importance to merit much attention, nor even to be all of them diſtinguiſhed by particular names. By the fruit was meant that annual part of every vegetable, which coheres, and is poſterior, to the flower, and, having attained maturity, lodges itſelf ſpontaneouſly in the ſoil, whence, when properly nurſed, it emerges an infant plant, in every reſpect ſimilar to its parent-vegetable. In this definition were manifeſtly included both the ſeed-veſſel, vulgarly called the fruit, and the ſeeds, which are its eſſence.

It was in 1560 that Geſner, thoroughly convinced of their ſufficiency, propoſed to the world his idea of an arrangement

from the parts of the flower and fruit. No plan, however, was eſtabliſhed by Geſner upon this principle; the idea was ſuggeſted, but the application left to be made by others; and it was not till 1583, that Dr. Andrew Cæſalpinus, a phyſician of Piſa, and afterwards profeſſor of Botany at Padua, availing himſelf of the ingenuity of his predeceſſor, propoſed a method which has the fruit for its baſis; and thus gave origin to ſyſtematic Botany, the ſecond grand æra of the hiſtory of the ſcience.

In propoſing the parts of fructification as the propereſt for arranging plants, Geſner communicated no hints reſpecting the choice that was to be made of ſome of thoſe parts in preference to others. Each particular organ of the flower and fruit furniſhes ſufficient variety to ſerve as foundation of a method: yet all are not equally proper for that purpoſe. The firſt ſyſtematic writers made choice of the fruit, as being the moſt eſſential part of vegetation. Unaccuſtomed to examine the ſubject with that philoſophical minuteneſs which characterizes the botaniſts of theſe days, they were not aware, that the figure of the fruit is always more liable to change than that of the flower; and that this laſt being prior to the other, and appearing at a time the moſt proper for botanical reſearches, ſeemed pointed out by nature as peculiarly adapted for furniſhing claſſical diſtinctions. In ſummer, when plants are in their higheſt perfection, and the blooming face of nature invites to theſe innocent and pleaſing enquiries, the man who would attain a knowledge of vegetables, muſt not think of deriving it from a method founded on the fruit. Such a method will prove an unſurmountable obſtacle in his way: the ſeaſon invites in vain; in vain does inclination lend her powerful aſſiſtance; he cannot advance a ſingle ſtep; he becomes chagrined, judges the undertaking impracticable, and abandons it in diſguſt.

The parts of the flower having been frequently employed by the firſt ſyſtematic writers, as ſubaltern diſtinctions, in diſcriminating orders and genera, it is evident that the plant to be explored could often not be referred to its proper genus and ſpecies for months after the inveſtigation of its claſs. Suppoſe a plant ripens its fruit in October, and does not produce flowers till the following May, the claſs, upon inſpection of the fruit, is immediately aſcertained, but the plant ſtill remains unknown, and will continue ſo for upwards of ſix months after, if the characters of the order or genus have been made to depend on any part of the flower. In ſome methods founded on the flower, no inconvenience of this kind can exiſt. The claſs is always determined by that part of the flower which furniſhes the leading character of the method: the orders and genera, which come next to be aſcertained, frequently borrow their diſtinctive marks from other parts of the flower; and if, as ſometimes happens, the fruit is made a ſubaltern diſtinction, it is generally ſo combined with ſome characteriſtic of the flower, that the genus can, in moſt caſes, be explored with the ſame facility as the claſs: I ſay generally, becauſe in the methods in queſtion, there are inſtances of generical characters founded ſolely on the fruit; but beſides that ſuch inſtances are exceedingly rare, they ſtand vindicated from this conſideration, that the progreſſion from the flower to the fruit, is much more natural than that from the fruit to the flower.

Methods founded on the fruit have another inconvenience, and that not ſufficiently attended to. Plants conſtantly ripen their fruit in thoſe countries where they are native: But do all plants without exception poſſeſs the ſame faculty in every country to which they may accidentally be tranſported? The fact is otherwiſe. Many plants that are natives of a very warm climate, neither ripen nor form fruit, upon being removed into a cold one.

Few

Few of the African, Aſiatic and Weſt-Indian plants produce fruit in England. A method therefore founded upon the fruit could only facilitate the knowledge of ſuch plants to the inhabitants of the ſeveral countries where they naturally grow. To the Engliſh botaniſt it could afford ſcarce any aſſiſtance. The ſame objection cannot, with reaſon, be urged againſt methods founded on the flower; ſince the influence of climates much colder than that of England has not been able to deſtroy the faculty of producing flowers in many, perhaps moſt of the plants that were juſt mentioned. Neither is the preſence of the fruit ſo neceſſary a circumſtance in ſome methods which have the parts of the flower for their baſis, as in thoſe of the firſt ſyſtematic writers. In the former, as we have ſaid, the generical character ſeldom depending on the fruit alone, the plant in queſtion may, in moſt caſes, be explored without its aſſiſtance: in the latter, the claſs cannot be aſcertained in abſence of the fruit: and if the claſs is not known, it is impoſſible that the genus ever ſhould.

Having ſaid ſo much in favour of methods founded upon the flower, I ſhould be inexcuſably partial not to mention a very ſtriking inconvenience of which they have been productive. The parts of the flower engroſs the ſole attention of modern botaniſts. Thoſe of the fruit are almoſt totally neglected. Nothing can be more prepoſterous or abſurd. For without enquiring, with Linnæus, whether the powder incloſed in the tops of the ſtamina is of ſufficient importance to the plant to juſtify our minuteſt reſearches into that organ, the ſeed-veſſel and ſeeds are confeſſedly organs of, at leaſt, equal importance, and therefore entitled to an equal ſhare of attention. True, the parts of the flower conduct with greater facility to the knowledge of plants; and, on that account, merit attention as the main agents of vegetable arrangement: but the parts of the fruit are no leſs deſerving

ſerving our regard, from their own intrinſic worth, their confeſſed importance in vegetation, and agency in perpetuating the ſpecies.

For theſe reaſons, the firſt ſyſtematic writers attached themſelves to the fruit, in preference to the flower; and it was not till upwards of a century after Cæſalpinus, the Father of Syſtem, that Rivinus, profeſſor at Leipſic, ſenſible of the difficulties which his predeceſſors had encountered, and deſirous to avoid them, produced another revolution in the ſcience, by propoſing a method founded on the regularity and number of the petals. We are not, however, to ſuppoſe that, in this long interval, claſſical diſtinctions were ſolely furniſhed by the parts of the fruit. Characters drawn from the habit or general appearance of plants ſtill maintained their conſequence; and theſe combined with ſome of the external parts more or leſs connected with fructification, ſerved effectually to deſtroy the uniformity of the methods into which they entered. In fact, Syſtem did not all at once attain that degree of purity and perfection to which it has now arrived. It was long debaſed by an alloy of the groſſeſt kind, which time, and time only, could expel. That alloy is now no more; the rubbiſh which choaked up the avenues to the ſcience is removed; its luxuriances are ſkilfully pruned; and Syſtem has reached its ultimatum of perfection.

Cæsalpinus ſets out with the ancient diſtinction of vegetables from their duration into trees and herbs. With the former he combines ſhrubs; with the latter, under-ſhrubs. Trees, the firſt grand diviſion, are diſtributed into two claſſes, from an attention to the ſituation of the radicle or principle of life in the ſeed. In ſome trees, as the oak, elm, beach, walnut, aſh, olive, ſumach and cherry, the radicle is ſeated in the *apex* or ſummit of

of the ſeed: in others, as the fig, mulberry, holly, roſe, medlar, apple, tamarind, pine, fir, cypreſs and juniper, its place is in the baſe. The ſame beautiful diſtinction is frequently uſed by this author as a ſecondary character in diſcriminating the ſections or orders of herbaceous plants. In the ſecond grand diviſion, containing under-ſhrubs and herbs, are thirteen claſſes conſtituted from the number of ſeeds, ſeed-veſſels and their cavities or internal diviſions. Some plants have only a ſingle ſeed, as valerian, nettle, hemp, dock and the graſſes. Theſe conſtitute the third claſs in Cæſalpinus's method. The fourth conſiſts of herbs with an undivided ſeed-veſſel of the apple and berry kind, containing ſeveral ſeeds; and is exemplified in cucumber, briony, honeyſuckle, deadly night-ſhade, and herb-chriſtopher. The plants of the fifth claſs agree with the former in having ſeveral ſeeds contained within an undivided caſe or ſeed-veſſel, but differ in the nature of that veſſel, which, in the claſs in queſtion, is dry, and of the capſule and pod kind. Pink, primroſe, ſwallow-wort and the pea-bloom or butterfly-ſhaped flowers furniſh examples. Theſe three claſſes exhauſt what Cæſalpinus terms his *ſingle principle* of diſtribution; the ſeeds being either ſingle, or contained in a veſſel with a ſingle cavity. In the claſſes which follow, the number of ſeeds, caſes or cells is two, three, four or many. The ſixth claſs contains all the umbelliferous plants, which have two naked ſeeds; the ſeventh, ſuch plants as have a double receptacle for the ſeeds, that is, a ſeed-veſſel divided into two cells. It is exemplified in madder, mercury, ſpeedwell and moſt of the croſs-ſhaped flowers. In the two following claſſes, the plants have a triple receptacle for the ſeeds, in other words, a ſeed-veſſel divided internally into three cavities or cells: but appearing too numerous to be arranged in one claſs, Cæſalpinus has, very unſyſtematically, borrowed diſtinctions from the roots, and diſtributed them into two claſſes, one of which contains fibrous, the other bulbous-

rooted

rooted plants. The former, which is the eighth claſs, is exemplified in convolvulus, violet and St. John's wort; the latter in hyacinth, tulip, lilly, narciſſus, and the other well-known liliaceous bulbous-rooted plants. The tenth claſs ſtands ſolitary, and conſiſts of plants which have four naked ſeeds. Bugloſs, lungwort, comfrey, hound's tongue, ſage, germander, roſemary, and the other lip-flowers furniſh examples. The principle of diſtribution in the four following claſſes is the ſame. In the eleventh, twelfth and thirteenth, the flowers are ſucceeded by a number of naked ſeeds: in the fourteenth, the ſeeds are numerous, but contained either in ſeveral capſules, or in one capſule that is divided internally into ſeveral cells. The two firſt-mentioned claſſes contain all the compound flowers; the thirteenth conſiſts of ſuch ſimple flowers as have many naked ſeeds, and is exemplified in ranunculus, adonis, virgin's bower, herb-bennet and cinquefoil. The reader will naturally aſk how theſe three claſſes are to be diſtinguiſhed from each other in a method which has not the parts of the flower for its baſis. By this certain rule, that in the thirteenth claſs, the flower is common to all the ſeeds; whereas in the two preceding claſſes, each ſeed has its own proper floret, or, as Cæſalpinus expreſſes it, the flower is diſtributed by parts on the top of each ſeed. The compound flowers arrange themſelves into two claſſes from the different ſituation of the radicle or heart of the ſeed, which in ſome is placed towards the middle, and in others towards the baſe. The former conſtitute the eleventh claſs of this method, and correſpond to the radiated flowers of later botaniſts: the latter, the twelfth, and include compound flowers whoſe florets are either all flat, or all hollow; ſuch are lettuce, nipple-wort, dandelion, hawk-weed, centaury, ſaw-wort and thiſtle. The thirteenth and fourteenth claſſes have already been illuſtrated: this laſt is exemplified in columbine, hellebore, houſe-leek, navel-wort, poppy, water-lilly, birth-wort and aza-

lea; the four firſt of which have ſeveral capſules; the four laſt a ſingle capſule with ſeveral internal diviſions or cells. It only remains to characterize the fifteenth claſs, which ſerves as an appendix to the method, and conſiſts of plants that have neither flower nor fruit. The ferns, flags, moſſes and muſhrooms, which, from our imperfect knowledge of their ſtructure, form a ſimilar diviſion in every method, conſtitute the concluding claſs in that of Cæſalpinus.

Such are the outlines of the firſt attempt towards a genuine ſyſtematic arrangement. To form a proper eſtimate of its merits or defects, we muſt previouſly aſcertain the facility or difficulty with which it conducts to the knowledge of plants: and this we can in no way ſo certainly determine as by recurring to particular inſtances. A carnation is preſented to me, which I am to refer to its proper claſs in Cæſalpinus's arrangement. Is the plant in flower? I am immediately at a ſtand: it can never be reduced to its claſs in that ſtage of vegetation. It muſt have ceaſed to flower; it muſt have ripened, or, at leaſt, have begun to form, its ſeed-veſſel or ſeeds. This preliminary adjuſted, my firſt enquiry is, to which of the two grand diviſions does the plant in queſtion belong? In other words, is it a tree, or an herb? To ſolve this query, I may frequently be obliged to wait for ſeveral months; becauſe the anſwer to it is principally regulated by the duration of the ſtem. Behold me then at a ſtand a ſecond time. I know it will be ſaid that this is an exaggerated repreſentation; that I paint imaginary difficulties; and that he muſt be a novice indeed, who, in ſuch circumſtances, cannot diſtinguiſh at ſight a tree from an herb. I grant it; he would be a novice; but let it be remembered that the ſole intention of arrangement is to facilitate the knowledge of plants: the learned need no ſuch auxiliary; it is the novice only that requires it: and that ſyſtem is undoubt-

undoubtedly the moſt excellent, which beſt accommodates itſelf to the wants of the mereſt novice—an axiom which, although ſelf-evident, has been ſo little regarded, that the diſtinction into herbs and trees was ſucceſſively adopted by every ſucceeding writer to the time of Rivinus, by whom it was very properly rejected as uncertain, and unconnected with fructification. To return to my plant. Having no certain criterion of the juſtneſs of my determination, I muſt have recourſe to conjecture, a dangerous interloper in ſcience, which much oftener conducts to error than truth. Suppoſing, however, that I am fortunate enough to gueſs right, and refer the plant in queſtion to that diviſion of the method which contains herbaceous vegetables: how am I next to proceed? By the determination juſt given, two claſſes are entirely cut off; thoſe, to wit, containing trees and ſhrubs: and I have to ſeek for my plant among the thirteen claſſes which remain. The preſence of the fruit implying the previous exiſtence of the flower, ſerves effectually to exclude it from the fifteenth claſs which conſiſts of plants that have neither flower nor fruit. I now examine the fruit particularly, and diſcover it to be a ſingle undivided capſule containing numerous ſeeds. My plant then cannot belong to the third claſs, the character of which is a ſingle ſeed; nor to the fourteenth, becauſe although the plants pertaining to it bear numerous ſeeds, they are contained either in more capſules than one, or in a ſingle capſule with ſeveral cells. Its pretenſions to a place in the eleventh, twelfth and thirteenth claſſes are equally ill-founded, becauſe in theſe, the ſeeds, though numerous, are naked, that is, have no capſule or caſe. In the tenth claſs, the number four; in the eighth and ninth, the number three; and in the ſixth and ſeventh, the number two, predominates; but neither two, three nor four, predominates in the fruit in queſtion: and therefore the plant cannot be referred to any of theſe claſſes. There remain

only the fourth and fifth claſſes, to one or other of which the plant in queſtion muſt belong. Theſe two claſſes differ only in the nature of the ſeed-veſſel, which, in the former, is pulpy, in the latter, dry. But the plant to be explored has a ſeed-veſſel that is dry, not pulpy; and is therefore to be referred to the fifth claſs, the plants of which have numerous ſeeds contained in a ſingle undivided capſule.

In this manner are plants referred to their proper claſs in Cæſalpinus's method, though not all with equal facility. There are ſome even which, poſſeſſing the characters of two diviſions, arrange themſelves indifferently under either. Swallow-wort is referred by the author to the fifth claſs, although its double ſeed-veſſel ſeemed to give it an equal title with the pæony to a place in the fourteenth. Defects of another, though not groſſer, nature, deſerve likewiſe to be mentioned. The compound flowers are diſtributed into two claſſes by a diſcriminating character which is not ſufficiently conſpicuous, the ſituation of the radicle in the ſeed. There is a confuſed jumble too, in the method, of ſeeds, ſeed-veſſels and cells: and an obſcurity as well as ambiguity in many of the ſcientific terms which render it a perplexed uninviting ſyſtem. In fine, as a firſt attempt, the method juſt illuſtrated poſſeſſes conſiderable merit, but can never be characterized a convenient eaſy mode of arrangement.

The ſections, orders or ſecondary diviſions in Cæſalpinus's method are forty-ſeven in number, and depend upon a variety of parts and circumſtances. The principal of theſe are, the diſpoſition, ſituation and figure of the flowers; the nature of the ſeed-veſſel or cover of the ſeeds; the ſituation of the radicle in the ſeed; the number of ſeed-lobes or ſeminal leaves; the diſpoſition of the leaves, and colour of the flowers. The lacteſcence

ſcence too or milkineſs, which is obſerved in the compound flowers with flat florets, is made a characteriſtic diſtinction, and diſcriminates the firſt order of the twelfth claſs. Thus it is the characters of the claſſes only which, in the firſt ſyſtematic arrangements, were ſolely borrowed from the parts of fructification; thoſe of the ſubaltern diviſions were numerous, and reſpected every part of the plant. Such diviſions, to be perfect, ſhould be conſtituted, like claſſes, from the modifications of a ſingle part of fructification. There are few methods that are not defective in this reſpect: and though I would by no means condemn a plan of arrangement for a ſlight deviation from uniformity in its ſecondary characters, I can have no favourable idea of the leading principle of any method which compels the uſe of a multiplicity of characters from different parts of the plant for diſcriminating the ſubaltern diviſions juſt mentioned.

It might have been expected that a method founded like that of Cæſalpinus upon genuine ſcientific principles, would have been immediately adopted by the learned, and, in eſtabliſhing itſelf, have totally extirpated thoſe inſufficient characters which, during ſo many ages, had diſgraced the ſcience. The fact, however is, that Syſtem periſhed almoſt as ſoon as it had an exiſtence: with Cæſalpinus died his plan of arrangement; and it was not till near a century after, that Dr. Robert Moriſon, of Aberdeen, in Scotland, attaching himſelf to the principles of Geſner and his learned ſucceſſor, re-eſtabliſhed ſcientific arrangement upon a ſolid foundation; and, from being only the reſtorer of Syſtem, has been generally celebrated as its founder. In the long interval betwixt Cæſalpinus and Moriſon, flouriſhed ſome eminent names in Botany. The moſt noted of theſe are, Dalechamp, author of a General Hiſtory of Plants; Theodore, ſurnamed Tabernæmontanus and Thalius, two German writers; Porta, an

Italian,

Italian, famous for an arrangement of plants from their relations to the ſtars, to men, and other animals; Proſper Alpinus, author of a catalogue of the plants of Egypt; Fabius Columna, inventor of many of the botanical terms now uſed; the two Bauhins; our two induſtrious countrymen, Gerard and Parkinſon; Zaluzianſki, a Pole, author of an arrangement from the qualities and habit of plants; Marcgrave and Piſo, celebrated for their Natural Hiſtory of Braſil; Hernandez, equally celebrated for his of Mexico; Paſſæus or Du Pas, author of an arrangement of plants from the time of flowering, of all characters the moſt uncertain and inſufficient; Johnſton; Bontius a Dutchman, author of a Natural Hiſtory of the Eaſt Indies; Aldrovandus, the celebrated Naturaliſt; and Rheede, Governor of Malabar, and author of the well-known *Hortus Malabaricus*.

The method propoſed by Moriſon has the fruit for its baſis, like that of Cæſalpinus, to which, however, it is greatly inferior both in the plan and execution. It was Moriſon's great object to inveſtigate the order of Nature, not to fabricate an eaſy method of arranging plants. Hence his ſyſtem, devoid of uniformity, is clogged with a multiplicity of characters; the claſſes are often not ſufficiently diſtinguiſhed from each other; and the key of the arrangement ſeems totally loſt. Moriſon ſets out with a diviſion of plants, from their ſubſtance or conſiſtence, into lignous or woody, and herbaceous. The former, ſubdivided, from their ſize, into trees, ſhrubs and under-ſhrubs, form the three firſt claſſes in the method. Herbaceous plants, which conſtitute the ſecond diviſion, are contained in fifteen claſſes, which have for their characters, the number, figure and ſubſtance of the fruit, the diſpoſition of the flowers, the preſence or abſence of the downy crown of the ſeed, termed *Pappus*, the lacteſcence or milkineſs of ſome plants, the number of petals, and the habit, port or general

neral appearance. The fourth claſs contains climbing plants which have a pulpy fruit of the berry and apple kind; and is exemplified in paſſion flower, briony and cucumber. The fifth and ſixth contain all the pod-bearing plants; and correſpond to the pea-bloom and croſs-ſhaped flowers of later botaniſts. Pods are of two kinds; the one, termed *Legumen*, has two valves or openings, and but one cell: the other, *Siliqua*, has two valves, and the ſame number of cells divided by a partition that runs either parallel to the valves, or in a contrary direction. The leguminous plants conſtitute the fifth; the ſiliquoſe the ſixth claſs, in Moriſon's method. The ſeventh claſs contains plants with ſix petals and a tricapſular fruit, by which the author means a ſingle capſule with three internal cavities or cells. All the liliaceous or bulbous-rooted plants are referred to this diviſion. A variety of plants are made to arrange themſelves promiſcuouſly under the eighth claſs, without any fixed or preciſe diſtinction. The number of petals and cavities of the fruit is announced in the title as the diſcriminating character. In the two next claſſes are placed all the compound flowers, which ſtand thus diſtinguiſhed. Thoſe of the ninth claſs, termed *corymbiferous*, from their growing in cluſters like ivy-berries, have neither a downy crown to the ſeed, nor a lacteſcent or milky ſtalk: thoſe of the tenth on the other hand, have either a lacteſcent ſtalk, or a downy crown to the ſeed. The former claſs is exemplified in tanſy, wormwood, daiſy, fever-few, and milfoil; the latter in ſuccory, hawkweed, dandelion, ragwort, and thiſtle. Under the eleventh claſs are arranged the numerous tribe of graſſes, whoſe characteriſtic diſtinction in this method is a ſingle ſeed to each flower. The twelfth claſs contains the plants termed *umbelliferous*, which have two naked ſeeds joined at their origin, and whoſe flowers conſiſt of five petals, and grow in an umbel. A three-corned capſule with three cells, each containing a ſingle ſeed, characterizes the thirteenth

claſs,

claſs, which is exemplified in ſpurge, and palma chriſti. The fourteenth conſiſts of plants which have flowers with one petal, and four naked ſeeds. It includes both the lip-flowers and rough-leaved plants of Tournefort and Ray. In the fifteenth are placed ſuch plants as have either more than one capſule, or a ſingle capſule with ſeveral cells. It correſponds to the fourteenth claſs in Cæſalpinus's method, and is exemplified in pæony, houſe-leek, and water-lilly. The ſixteenth claſs contains berry-bearing plants which do not climb. Deadly night-ſhade, arum and cyclamen, furniſh examples. The ferns, a well-known tribe of plants, occupy the ſeventeenth claſs, by the name of capillary herbs: and in the eighteenth, which ſerves as an appendix to the method, are placed the moſſes, muſhrooms, ſea-weed, ſeveral aquatic, and ſome other, plants which cannot be referred to any of the foregoing heads.

FROM this ſynopſis the reader may form an adequate judgment of the method under review. It is, indeed, of all others, the moſt difficult in practice, and was therefore not adopted by any ſucceeding writer, except Bobart, who, in 1699, compleated Moriſon's Univerſal Hiſtory of Plants, and an anonymous author, whoſe work appeared in 1720. The fourth and eighth claſſes poſſeſs no genuine diſtinctive character. With the umbelliferous plants are very improperly joined drop-wort, meadow-rue and the *ſtarry* plants of Ray, which laſt have one petal with four diviſions, the flowers not diſpoſed in an umbel, and the leaves placed in whorls reſembling a ſtar round the ſtem. The ninth and tenth claſſes, containing compound flowers, are not ſufficiently diſtinguiſhed; in the latter too are arranged teazel, eryngo, pine-apple, protea, and melon-thiſtle, which have neither a downy crown to the ſeed, nor a milky ſtalk, the diſcriminating characters of the claſs in queſtion. Garden burnet and plantain are made to arrange

range themſelves with the graſſes, although in the former, two, in the latter, ſeveral ſeeds ſucceed each flower. With juſt as little propriety are wood-ſorrel, ſtrawberry, cinquefoil, ladies mantle and barren-wort, which bear no pods, referred to the claſs containing leguminous plants; and anemony, ranunculus and herb-bennet, which have ſeveral naked ſeeds, to the ſeventh claſs, conſiſting of plants with a capſule that has three internal diviſions or cells. The fifteenth claſs is not ſufficiently diſtinguiſhed from the eighth, nor the ſixteenth from the fourth. In this laſt, the characteriſtic diſtinctions are a ſeed-veſſel of the berry or apple kind, and a climbing ſtalk; and yet the title of the very firſt ſection, or ſub-diviſion of the claſs, announces the preſence of berry-bearing plants which do not climb. To the ſame claſs are improperly referred bind-weed, quamoclit, hop and heart-ſeed which have not a berry for their ſeed-veſſel.

Morison's ſections or ſecondary diviſions, which are one hundred and eight in number, ariſe from the figure and ſubſtance of the fruit, the number of ſeeds, leaves and petals, the figure of the root, the direction of the ſtem, the colour of the flowers, the place of growth, and, in one claſs, from the medicinal virtues of ſome of the plants which compoſe it.

It is remarkable, that, altho' Moriſon ſet out with the profeſſed deſign of inveſtigating as many of the natural claſſes as poſſible, he has been able to diſcover but two that are compleatly ſo. Theſe are the thirteenth, which, however, contains but two genera, and the ſeventeenth, comprehending the ferns. Some of the other claſſes, particularly thoſe containing the leguminous, ſiliquoſe, and umbelliferous plants, and the compound flowers, have forfeited their title to that appellation, by being encumbered with

ſeveral plants, between which the relations are not ſufficiently numerous.

IMPERFECT as is the mode of diſtribution propoſed by Moriſon, it has furniſhed many uſeful hints, which later botaniſts have not failed to improve. Ray, Tournefort and Linnæus, thoſe great luminaries of the ſcience, have ſucceſſively owed him much, nor are aſhamed to acknowledge the obligation. The firſt-mentioned writer propoſed his method to the world, in 1682, two years after the publication of Moriſon's, which ſerved, in ſome ſort, as its baſis. It orginally conſiſted of twenty-five claſſes, two of which reſpect trees and ſhrubs, and the remaining twenty-three herbaceous plants. This method Mr. Ray carefully retouched, corrected and amended at different times; ſo that the plan of arrangement which now bears the name of that author, and was firſt publiſhed in 1700, is entirely different from that which had appeared in 1682. The thirty-three claſſes of which the improved method conſiſts are derived from the port or habit of plants; their greater or leſs degree of perfection; their place of growth; the number of ſeed-lobes or ſeminal leaves, petals, capſules and ſeeds; the ſituation and diſpoſition of the flowers, flower-cup and leaves; the abſence or preſence of the buds, flower-cup and petals; the ſubſtance of the leaves and fruit; and the difficulty of claſſing certain plants.

THE diſtinction into herbs and trees, with which Ray's method ſets out, acknowledges a different, though not more certain, principle, than that of Cæſalpinus and Moriſon. The former, in making this diviſion, had an eye, with the ancients, to the duration of the ſtem; the latter, to its conſiſtence. Ray has called in the buds as an auxiliary, and denominates trees all ſuch plants as bear buds; herbs, ſuch as bear no buds. The objection which

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lies againſt Linnæus's diſtinction into ſhrubs and trees from the ſame principle, may be ſtill more powerfully urged in the preſent caſe: for though all herbaceous plants riſe without buds, all trees are not furniſhed with them: many of the largeſt trees in warm climates, and ſome ſhrubby plants in every country, being totally devoid of that ſcaly appearance which conſtitutes the eſſence of a bud.

HERBACEOUS vegetables, which conſtitute the firſt grand diviſion, are diſtributed into a double phalanx of plants which bear flowers, and ſuch as are devoid of flowers. This diſtinction was ſubſtituted in the improved method for that leſs philoſophical one of perfect and imperfect plants, which had been originally employed. The four firſt claſſes exhauſt the diviſion ariſing from the abſence of the flower. Of theſe the ſubmarine plants occupy the firſt; the muſhrooms, moſſes and ferns, the remaining three. Submarine plants are ſuch as grow in the bottom of the ſea, or upon rocks that are ſurrounded by that element. They are either of a very hard ſtony nature, as the plants termed Lithophyta; of a ſubſtance reſembling horn, as the corallines; or of a ſofter, herbaceous texture, as the fuci, ſpunges, and ſea-moſſes. The corallines have ſucceſſively paſſed through each of the three great claſſes or kingdoms of Nature. Some Naturaliſts have not ſcrupled to refer them to the mineral kingdom; the greater part have arranged them with vegetables; and it was not till lately that their real nature was clearly aſcertained, and they demonſtrated, by a ſeries of well-atteſted experiments, to be true ramified animals. The animality, if I may uſe that expreſſion, of this ſingular tribe of natural bodies had been juſt hinted at by Imperati, an Italian, in 1599, and afterwards, by Peyſſonel in 1727: but it is to M. Bernard Juſſieu, a French academician, and the ingenious Mr. Ellis, that we owe deciſive facts, and a regular detail upon this

ſubject. The former, in ſeveral papers to be found in the Memoirs of the French Academy of Sciences for 1741, has demonſtrated theſe marine bodies to be true animal productions; the latter, in his Natural Hiſtory of Corallines, has, with indefatigable labour, parcelled them out into their ſeveral genera, by means of fixed, invariable characters obvious in their appearance.

THEIR place of growth, which is out of the water, ſerves to diſcriminate muſhrooms, moſſes and ferns, the three remaining claſſes of plants that want the flower, from the ſubmarine productions which conſtitute the firſt claſs. But how are they diſtinguiſhed from one another? Of all the vegetable tribes, muſhrooms are the leaſt certainly known. With the more perfect plants, indeed, they poſſeſs ſcarce any characters in common. They have no leaves; in colour and texture they generally differ from herbaceous plants: and it was not till 1729 that Micheli diſcovered in ſome of them appearances reſembling ſtamina and ſeeds. Moſt of them attain the higheſt perfection of their nature in a very ſhort ſpace of time, and diſappear with proportionable celerity. Mr. Ray ſubdivides the muſhrooms into two orders or ſections; the one containing ſuch as have the under part of the crown or hat divided into *Lamellæ* or thin plates; the other ſuch as exhibit no appearance of this kind. In the firſt order the hat, which is generally ſupported by a footſtalk, does not poſſeſs the ſame conſiſtence throughout. The upper ſurface is homogeneous, undivided, and generally of the ſame colour internally with the footſtalk: the lower is moſt commonly of a different colour, and divided into thin plates. Muſhrooms which have nothing analogous to the thin plates juſt mentioned, are of various forms: ſome are of a ſubſtance reſembling parchment or leather, as Jew's Ears; others imitate in conſiſtence a honey-comb: ſome are club-ſhaped, ſome round, ſome branched. In both orders there

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are parasitic plants, which draw nourishment from the trees that support them. Jew's Ears is produced upon the elder; agaric upon the larch. Truffles, known among botanists by the name of *tubera terræ*, are produced under-ground. Ray's characters of the mosses are not in the spirit of genuine systematic arrangement. The fructification of that numerous tribe of plants had not then been discovered; so that a general description of the class was necessarily substituted for true scientific distinctions. Mosses are defined to be vegetables of extreme minuteness, and of a dry, arid substance, which grow upon stones and trees, in squalid barren places that are burnt up by heat, or impoverished by cold. They possess likewise the singular property of resuming their original verdure, by immersion in water, after having been dried for years; and are so slow in transmitting heat and cold, that it is found convenient to employ them in preserving dry such bodies as are susceptible of moisture, and in retaining the humidity of young plants, which are to be transported to a great distance, without exposing them to putrefaction. The *antheræ* and seeds of the mosses were detected by Dillenius in 1719 and 1741. At the first publication of his method, Ray considered the ferns as a sort of ramified leaves, and hence adopted for their distinctive character, the absence of the stem. In the sequel, however, he was convinced that the character in question, however proper for discriminating the European ferns, was altogether inadequate for distinguishing those of India and America, many of which have true genuine stems. Obliged then to abandon his first and most obvious distinction, because wanting in universality, he had recourse, in his improved method, to the minute organs of fructification, which, by the industry of some lovers of the science, had begun to be investigated. The illustrious Tournefort, whose method and judicious distribution of the genera furnished Ray with the greatest part of his corrections and amendments, had, in arranging

ranging the ferns, deſcribed them to be plants wanting the flower, but furniſhed with ſeeds, which grow upon the back of the ramified leaf or ſtem. Neither of theſe characters, nor both in conjunction, appeared to Mr. Ray ſatisfactory. Profeſſor Rivinus, Mr. Ray himſelf, and Father Plumier had, by this time, diſcovered the flowers of ſome of the ferns; and were hence led by analogy to conclude their exiſtence in all. The laſt mentioned author, in particular, deſcribing a ſhrubby American fern, ſays, that the ſeminal knobs on the back of the leaf appeared to be preceded by very ſmall florets of one petal, within which were a number of exceedingly minute filaments or threads. The other diſtinction employed by Tournefort reſpecting the place of the ſeeds, ſeemed equally improper. In royal oſmund, or flowering fern, and adder's tongue, the middle rib overtops the leaf, and forms a footſtalk for ſupporting the panicle or head of flowers. Thus the ſeeds are always ſeated upon the leaves, though not always upon their back or lower ſurface. Mr. Ray, therefore, to avoid all altercation, and render the diſtinctive character as exact as the nature of the tribe of plants would admit, has corrected Tournefort's deſcription, and, in the improved edition of his method, defined the ferns to be plants with a very minute duſty ſeed, which always grows on the leaves, and generally on their back or under ſurface. It deſerves to be remarked that Ray, although convinced of the exiſtence of the flower in theſe plants, has arranged them in a diviſion, the characteriſtic diſtinction of which is the abſence of that organ. The parts in queſtion were neither perfectly diſtinguiſhed, nor ſufficiently conſpicuous to entitle the plants to a place in a diviſion where the exiſtence of the flower was, in no ſort, dubious. Some ferns produce their ſeeds on the margin of the lower ſurface of the leaves, as maiden-hair, and the common female fern, generally known by the name of brakes: but the greater part produce them towards the mid-

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dle or inner ſurface; and that either in double rows of iron-coloured points or knobs, as in polypody, and moſt ſpecies of male fern; in vermicular or oblique lines, as in hart's tongue and black maiden-hair; in lines which run longitudinally downwards parallel to the middle rib of the leaves, near which they are placed, as in *blechnum*; or in cluſters over the whole ſurface, as in ſpleen-wort, generally known by the name of Ceterach of the ſhops. The ſtamina and ſeeds of ſome of the ferns were diſcovered by M. de Juſſieu in 1739; thoſe of ſeveral others by M. Maratti in 1760. Dr. Bobart is ſaid to have been the firſt who recognized the ſeeds of this tribe of plants.

We have now ſufficiently illuſtrated the four claſſes of plants in which the parts of the flower are either wanting, or obſcurely viſible, and aſſigned the characteriſtic diſtinction of each claſs. The diviſion of flower-bearing herbs, which comes next to be evolved, comprehends twenty-one claſſes; and theſe the author parcels out into a double phalanx, from an attention to the number of ſeed-lobes or ſeminal leaves. To underſtand the diſtinction referred to, the reader will pleaſe to obſerve that moſt ſeeds have two diſtinct nutritive lobes that enfold the radicle or embryo-plant, and commonly ſhoot up out of the ſoil, for the purpoſe of defending and nouriſhing the infant-ſtem, in the form of two leaves, termed Seminal, becauſe they are immediate productions of the lobes of the ſeed, and bear no reſemblance to the ſucceeding leaves of the plant. In pea, bean, and the other leguminous plants, the lobes in queſtion are diſtinctly viſible: but in theſe, it is to be obſerved, as likewiſe in the lip-flowers, and ſome other plants, they remain unchanged, and do not ſpring up in the form of ſeminal leaves. Again, there are herbaceous plants, tho' thoſe but proportionally few in number, which have only one lobe to the ſeed, and riſe with leaves perfectly ſimilar in form to

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the leaves which ſucceed. This being premiſed, Mr. Ray's diviſion of the flower-bearing herbs will be clearly underſtood. Nineteen claſſes, from the fifth to the twenty-third, both inclusive, contain herbaceous plants which have either two ſeed-lobes, or riſe with two ſeminal leaves. The twenty-fourth and twenty-fifth claſſes, the two laſt in the diviſion under review, conſiſt of plants which have only one ſeed-lobe, and conſequently, do not, like thoſe of the preceding claſſes, protrude, in germinating, two ſeminal leaves, of an irregular form, and totally unlike the leaves that are afterwards protruded.

Such is the foundation of Mr. Ray's diſtinction of plants into *Dicotyledonous* and *Monocotyledonous*. The former have two ſeed-lobes or ſeminal leaves, the latter but one. In both, the ſeed-lobe performs the office of the *cotyledon* or *placenta* in animals, by preparing the nouriſhment, and tranſmitting it elaborated to the infant plant. Herbs which have two ſeed-lobes, or riſe with two ſeed-leaves, are ſubdivided by Mr. Ray into ſuch as bear flowers with petals, and ſuch whoſe flowers have no petals. This diviſion requires to be explained. The preſence of the flower-cup, petals, ſtamina with their tops, and ſtyle or pointal conſtitutes a perfect flower. The ſtamina and ſtyle are eſſential to its exiſtence; their abſence therefore is incompatible with the idea of a flower; not ſo the flower-cup and petals; the former of which organs may be wanting, without deſtroying the perfection of the flower: the latter, though of more importance, does not, by its abſence, annihilate the flower, but only renders it imperfect. Upon this doctrine of Mr. Ray is founded the diſtinction juſt mentioned. Some herbaceous plants which riſe with two ſeminal leaves, bear flowers conſiſting of the ſtamina, ſtyle and flower-cup only, without the petals: but in the greater part, the flowers are perfect, that is, conſiſt of ſtamina, ſtyle and petals, with

with or without the cup. If in the ſecond branch of this diviſion no plants found a place that were not abſolutely compleat in the parts of fructification, I ſhould not ſcruple to pronounce it an excellent diſtinction. But Mr. Ray having arranged with the compleat flowers ſome which want the calix or flower-cup; and there being no certain criterion whereby to diſtinguiſh the calix from the petals in flowers which have only one of the covers preſent, we ſhall frequently be puzzled in aſcertaining to which branch of the diviſion the plant in queſtion ought to be referred. When both organs are preſent, there can be no doubt, even although the calix ſhould emulate the petals in colour, texture and fugacity, as it manifeſtly does in muſtard and crowfoot; or even in ſtability and duration, as in orpine and greater houſe-leek. In the caſe alluded to, the calix is always with facility diſtinguiſhed from the petals by its exterior ſituation, and uſe in containing and ſupporting the flower. But if one of the parts in queſtion only is preſent, by what rule ſhall we determine its genuine nature, and whether the organ that is wanting be more or leſs eſſential to the perfection of the flower? Let us hear Mr. Ray's ſentiments on this ſubject. The flower-cup, ſays that author, in his Diſſertation on the various plans of arranging vegetables, may always, with accuracy, be diſtinguiſhed from the petals, by its leſs delicate texture, its want of colour, and above all, its aptitude to continue till the maturity of the fruit, to which it frequently ſerves the purpoſe of a veſſel or covering. Hence it is, he continues, that thoſe flowers are to be deemed without petals, in which the parts that ſurround the ſtamina are of an herbaceous colour and conſiſtence, or continue upon the plant till the fruit has attained its full ſize and maturity; thoſe, on the other hand, want the flower-cup, in which the aforeſaid parts are either of a different texture and colour, or, devoid of ſtability, fall off or wither before the ripening of the ſeed. To take an example. In

the flowers of hop, nettle and hemp, the only cover preſent is determined to be the flower-cup, from its herbaceous texture and colour; as is likewiſe that of buck-wheat, biſtort and perſicaria, from its durability, although, in theſe laſt, the part in queſtion exactly reſembles petals in its form and colour. None of the characters aſſigned by Mr. Ray are ſufficient to diſtinguiſh the petals from the flower-cup. In plants which have both organs preſent, and it is in ſuch only that we can look for accurate marks of diſtinction, the flower-cup ſometimes falls off, as in the poppy and barren-wort, at the opening of the flower; ſometimes with the petals and ſtamina, as in the croſs-ſhaped flowers. Neither is the ſame part in all plants of an herbaceous colour; crow-foot, water-creſs, gold of pleaſure, Indian-flowering reed, broom-rape, calycanthus, and ſeveral others, have a coloured calix. In *bartſia*, it is red as blood. Again, in the paſſion-flower, the petals are of the ſame herbaceous colour as the calix; in the water-lilly, they are permanent, that is, continue till the fruit has attained maturity; and in the genus *ſelago*, perform the office of a capſule by incloſing and involving its ſingle ſeed. The truth is, that nature has placed no abſolute limits betwixt the calix and the petals; ſo that where either is wanting, no rule can be aſſigned that, in all caſes, ſhall determine, with certainty, the genuine nature of the organ that remains. In ſome plants, particularly ſparrow-wort, ſtar of Bethlehem, white hellebore, ſpider-wort, and ruſh, the two organs in queſtion grow together, and are formed into one and the ſame body; ſo that the flower, when unfolded, is outwardly of a coarſe texture and green herbaceous colour; inwardly, of a fine delicate frame and beautiful colour, which it often changes, when flowering is accompliſhed, for the herbaceous colour of the under ſurface, and, in this calix-like form, continues with the fruit to its maturity. This obſervation is as old as the time of Cæſalpinus. Neither are we, with ſome botaniſts,

botaniſts, to conclude that the petals, becauſe the more excellent organ, are never wanting; ſince, in flowers which have both calix and petals, the latter is occaſionally dropped, the former never. Bell-flower and water-purſlane furniſh examples of the fact alluded to. M. Tournefort has adopted for his primary and ſole diſtinction of petal-wanting flowers, the durability of the calix combined with its uſe in ſerving as a veſſel for incloſing and covering the ſeeds. The former character being proved to be inſufficient, the latter, which has no exiſtence without it, can ſcarce be deemed highly certain. In fine, I cannot help thinking both Ray and Tournefort's diſtinction of petal-bearing and petal-wanting flowers to be exceedingly improper, becauſe, in no ſort, calculated to facilitate the knowledge of plants. At the ſame time, I can conceive a very eaſy method of removing the ambiguity, by arranging under one diviſion all plants which are compleat in the parts of fructification, and under its oppoſite diviſion, ſuch plants as are deficient in either of the two covers of the flower generally known by the names of calix and petals. By ſuch a mode of diſtribution, a plant is no ſooner viewed than its place is finally and certainly determined: if both the organs in queſtion are preſent, it is referred, without heſitation, to the firſt diviſion; if only one, we loſe no time in enquiring, whether it is the calix or petal, but refer it, with equal facility, to the ſecond.

THE petal-wanting flowers conſtitute the fifth claſs in Ray's method. Of theſe ſome want both calix and petals, as glaſs-wort, triple-headed pond-weed, and *hippuris*; the reſt, which want only one of the covers, are ſubdivided into ſuch as have the flower placed at a diſtance from the fruit, and ſuch as have it contiguous. In hop, hemp, nettle, ſpinach, and mercury, the flower and fruit are produced upon different plants raiſed from the ſame ſeed. In *Ambroſia*, leſſer burdock, palma chriſti, and

baſtard ricinus, they ſtand upon different parts of the ſame individual plant; the ſtamina with its cover forming the flower, the ripened ſeed-bud the fruit. Of petal-wanting herbs which have the flower placed contiguous to the fruit, that is, the ſtamina ſituated along with the pointal or ſtyle within the only cover that is preſent, ſome have a three-cornered ſeed, as dock, buck-wheat, biſtort and knot-graſs; ſome a roundiſh ſeed, as orach, blite, pellitory, ladies mantle and rupture-wort; and others, as beet, golden ſaxifrage, amaranthus and plantain, have their ſeeds contained in a veſſel.

Herbaceous plants which riſe with two ſeed-leaves and have petals, come now to be conſidered. Theſe are contained in eighteen claſſes, and bear flowers which are either ſimple or compound. The compound flowers conſtitute the ſixth, ſeventh, eighth and ninth claſſes; in the fourteen claſſes which immediately ſucceed theſe, the flowers are all ſimple. This diſtribution, which is borrowed from Tournefort, requires explanation. A compound flower, according to Mr. Ray, is an aggregate of ſeveral partial or leſſer florets, each of which is furniſhed with its own proper petal, ſtamina, ſtyle and ſingle ſeed. In a flower of this deſcription, continues the ſame author, all the florets are contained within a common calix or flower-cup; the ſeeds are naked, cloſely arrayed, and placed each under its own proper floret; and there is a circle of larger petals in the circumference or margin of the aggregate, which ſurround the florets in the middle in the form of rays. By theſe characters, the author conceives that compound flowers may with facility be diſtinguiſhed from thoſe modes of flowering termed an *Umbel*, *Corymbus* and *Spike*, with which they might otherwiſe be confounded. He at the ſame time cautions us from wrongly imagining that either of the characters juſt mentioned is ſingly ſufficient to conſtitute a compound

pound flower. The preſence of the two firſt is abſolutely neceſſary. In fact, there are ſome flowers, as ſea-pink and horned rampions, which, although a real aggregate, and contained within a common calix, are not to be ranked as compound flowers, becauſe each floret is furniſhed with its own proper calix, and has likewiſe a capſule for containing the ſeeds.

The ſixth claſs of Ray's method contains compound flowers which conſiſt entirely of flat tongue-ſhaped florets. The plants of this claſs have a lacteſcent or milky ſtalk, and correſpond to part of the tenth claſs in Moriſon's method. They are diſtributed by Ray into two ſections; the firſt containing ſuch lacteſcent compound flowers as have their ſeeds furniſhed with a *pappus* or downy crown for their more convenient diſperſion; the ſecond, ſuch whoſe ſeeds are ſolid, that is, want the crown alluded to. Lettuce, hawkweed and dandelion arrange themſelves under the firſt ſection; ſuccory and nipple-wort, under the ſecond. The flowers of this claſs are defined by Jungius to be ſuch as have plain florets, and are naturally full. The ſeventh and eighth claſſes contain the radiated flowers of Tournefort. They are diſcriminated by the *pappus* or downy crown of the ſeed, which, in the former, is preſent, in the latter wanting. On the whole, however, theſe two claſſes are the leaſt accurately diſtinguiſhed both from one another, and from the other compound flowers, of any claſſes or ſections in the method. The ninth claſs contains compound flowers conſiſting of ſeveral oblong hollow florets, which are generally divided or cut into long ſegments. This claſs Mr. Ray has denominated *Capitatæ*, becauſe the common calix in the plants pertaining to it ſwells out, particularly after the fall of the flower, into a prominence reſembling a head. Thiſtle, blue-bottle, burdock and ſafflower furniſh examples. With the compound flowers are very improperly arranged ſcabious,

bious, teazel, blue daiſy and eryngo, which have not all the characters ſufficient to conſtitute a compound flower; each floret in the aggregate being furniſhed with its own proper calix, altho', like the flowers in queſtion, it is generally placed upon a ſingle naked ſeed.

HERBACEOUS plants with two ſeminal leaves and a ſimple flower conſtitute the next fourteen claſſes, and are ſubdivided from an attention to the ſeeds, which are either naked, or incloſed in a caſe or veſſel. The number of naked ſeeds next demands attention; and herein Mr. Ray differs from Cæſalpinus, who made number his primary diſtinction, ſubordinate to which was placed that ariſing from the preſence or abſence of a veſſel for containing the ſeeds. In the plants of the tenth claſs, each flower, which is perfect and ſimple, is ſucceeded by a ſingle naked ſeed. Sea lavender, marvel of Peru, valerian and fumatory are adduced as examples. The eleventh claſs conſiſts of herbaceous plants which bear two naked ſeeds. Theſe are the plants well known among botaniſts by the name of Umbelliferous, from the mode of flowering, which reſembles an umbrella. The footſtalks which ſupport the flowers in this tribe of plants proceed like rays from the ſame center, and riſe to an equal height, ſo as to form an even ſurface at top. Each ray too, in moſt umbelliferous plants, is branched out, near the top, into ſeveral partial or leſſer footſtalks, which ſupport a ſecondary umbel in every reſpect ſimilar to the larger or univerſal one; this laſt being in fact only an aggregate of the ſeveral leſſer umbels juſt mentioned, which altogether form the figure of an inverted cone. The umbelliferous plants are diſtributed by Ray, from the form of the leaves, which, in ſome, are ſimple and undivided; but in the greater number, winged or branched, that is, cut into ſeveral lobes or partial leaves. Of umbelliferous plants with divided or

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diſſected leaves, ſome have broad compreſſed ſeeds, with a leafy wing or border, as cow-parſnep, hart-wort, fennel-giant, and maſter-wort; in others, the ſeeds ſwell out into a different form, and are either very large, of a fungous ſubſtance, and contain a kernel, as in *cachrys*; of a ſpherical figure, as in coriander; long, narrow, and reſemble a bird's beak, as in chervil and Venus's comb; furniſhed with many membranaceous wings that run longitudinally downwards, as in laſerwort; long, large and furrowed, as in myrrh, ſometimes known by the name of ſweet fern; ſtreaked, and of a middling length and thickneſs, as in ſpignel, lovage and fennel; hairy, as in carrot; or prickly, as in baſtard parſley. Sanicle, hare's ear and black maſterwort, are the umbelliferous plants with ſimple leaves; to theſe may be added eryngo, which Ray has placed very improperly among the compound flowers. The twelfth claſs contains plants which, like thoſe of the former, have two naked ſeeds under each flower, but are in other reſpects ſo very unlike the umbelliferous plants, that Mr. Ray has judged very properly in correcting this part of Moriſon's plan, which jumbled theſe two claſſes promiſcuouſly together. The plants in queſtion have their flowers deeply cut into four ſegments reſembling ſo many diſtinct petals; and the leaves placed in whorls round the ſtalk at certain diſtances, in the form of a radiant ſtar: from which laſt circumſtance is derived the name *Stellatæ*, that is, ſtar-like plants, by which the claſs under review is diſtinguiſhed. Mr. Ray ſubdivides theſe plants, from the tube of the flower, which in ſome, as petty madder, is long; but in the greater part, very ſhort. Of ſuch as have a ſhorter tube, ſome produce their leaves by fours in the form of a croſs; in others the leaves grow in greater number, and thoſe either ſmooth, as in yellow ladies bed-ſtraw and wild madder, the *galium mollugo* of Linnæus; or rough, as in cleavers, and woodroof. Four naked ſeeds in the bottom of the flower-cup

characterize the two next claſſes, which ſtand thus diſtinguiſhed. In the thirteenth the plants have rough leaves that are either placed alternately or without any order upon the ſtalk; and flowers of one petal, with the brims deeply cut into five ſegments. The flower-cup too is ſlightly divided into five; and, in ſome of the genera, the uppermoſt part of the ſpikes of flowers is twiſted, before their expanſion, into the form of a ſcorpion's tail. In the fourteenth claſs, the leaves are placed oppoſite by pairs; the flowers generally ſurround the ſtalk in whorls, and conſiſt of one petal with two irregular lips, the uppermoſt of which, in the greater number of plants, reſembles a helmet. The firſt mentioned claſs is exemplified in lungwort, comfrey, ſcorpion-graſs and borrage; the other in ſage, hyſſop, betony, roſemary, and the other lip-flowers. Moriſon joined theſe two claſſes into one; Ray has with great propriety ſeparated them. The fifteenth claſs contains plants in which each flower is ſucceeded by more than four naked ſeeds. Crow-foot, adonis, water-plantain, tormentil, cinquefoil and herb-bennet, furniſh examples. In his Hiſtory and Synopſis of Britiſh Plants, Mr. Ray refers to this claſs the mallow tribe, which, in his improved method, he has very judiciouſly transferred to the nineteenth.

Such are the diſtinctions of ſimple flowers ariſing from the number of naked ſeeds. In the eight following claſſes, the ſeeds are contained in a caſe or veſſel, which is either pulpy or of a ſubſtance reſembling parchment. The ſixteenth claſs contains herbaceous plants which have a large ſucculent ſeed-veſſel of the apple kind, covered with a thick rind or ſkin. The flowers are of one petal with five ſlight diviſions, and ſtand upon the top of the fruit. Cucumber, gourd, melon, and balſam-apple, afford examples of the claſs in queſtion. Paſſion-flower too is arranged by the author with the plants juſt mentioned, although it agrees with

with them in nothing ſave the characteriſtic diſtinction of the claſs. The berry-bearing herbs which conſtitute the ſeventeenth claſs are diſtinguiſhed from thoſe having a pulpy fruit of the apple kind by the thin membranaceous ſkin that involves the pulp and ſeeds intermixed with it. Bryony, butcher's broom, night-ſhade, winter-cherry, capſicum, arum, aſparagus, and herb-chriſtopher, are referred with ſeveral others to this claſs. To each flower in plants of the eighteenth claſs ſucceed many diſtinct capſules or ſeed-veſſels of a membranaceous ſubſtance. They are divided into two ſections, from the conſiſtence of the leaves, which in ſome is thick and ſucculent; in others, ſlender and dry. Navel-wort and houſe-leek pertain to the firſt ſection; pæony, hellebore, apocynum, ſwallow-wort, monks-hood, columbine and fraxinella to the ſecond, which is ſubdivided from the regularity and irregularity of the flower. The plants with a ſingle dry membranaceous ſeed-veſſel are contained in the five ſucceeding claſſes, which ſtand diſtinguiſhed from the number of petals of which the flower conſiſts. In the nineteenth claſs, the plants have a ſingle membranaceous fruit or ſeed-veſſel with a divided or undivided cavity, and regular or irregular flowers of one petal. Tobacco, gentian, convolvulus, fox-glove, birthwort and toad-flax furniſh examples. The twentieth claſs, which was inſtituted by Dillenius, contains capſular plants with two or three petals, and is exemplified in enchanter's night-ſhade, frog's-bit and water-ſoldier. Ray's twenty-firſt claſs correſponds to the ſixth in Moriſon's method. In the plan under review, its characters are, flowers with four regular petals that are ſucceeded by ſeed-veſſels of the *ſiliqua* or pod kind. The flower-cup too, in moſt of the ſpecies, falls off with the flower; the leaves are placed alternately upon the ſtem; there is a conſtant ſucceſſion of heads of flowers on the ſummit of the branches; and the flower-ſtalks have no *ſtipulæ* or ſmall auxiliary leaves ſtationed at

their origin. Rue, epilobium, poppy, and ſome other plants, are made very unſyſtematically to arrange themſelves under the claſs in queſtion. The leguminous plants, which conſtitute the twenty-ſecond claſs, are characterized by Mr. Ray, after Tournefort, from the irregularity of their petals, which are generally four in number, and reſemble a butter-fly with its wings expanded. The petals agree neither in figure, proportion, nor ſituation; the uppermoſt, generally larger and broader than the reſt, is termed *the ſtandard*; the lowermoſt, involving and defending the ſtamina and embryo ſeed-veſſel, *the keel*; the two ſide petals which reſemble each other in form, *the wings*. Leguminous plants are primarily ſubdivided by Mr. Ray from the leaves, which in ſome are *trifoliate*, that is, compoſed of three diſtinct lobes or leſſer leaves connected on the top of a common footſtalk; in others, *pinnated* or *winged*, that is, compoſed of more leſſer leaves than three arranged on both ſides of a common *coſta* or middle rib; in ſome, finger-ſhaped; in others, ſimple. Of ſuch as have not trifoliate leaves, the greater part bear pods containing a ſingle row or ſeries of ſeeds; in a few, as aſtragalus and *biſerrula*, the pods are divided by a longitudinal partition into two cells, each containing its own proper ſeries. Again, ſimple pods are either jointed, or not jointed. The former are compoſed of ſeveral knots reſembling joints, in each of which is contained a ſingle ſeed; the latter have an undivided cavity and no joints. French honeyſuckle and horſe-ſhoe vetch furniſh examples of the jointed pod; lupine, pea and bean of that which has no joints. Of theſe laſt, ſome climb or are furniſhed with tendrils, as vetch, and everlaſting pea; others want tendrils, and have their leaves either finger-ſhaped, as in lupine; pinnated or winged, as in ſaint foin and liquorice; or ſimple, as in crimſon-graſs vetch, the *lathyrus niſſolia* of Linnæus. Leguminous plants with trifoliate leaves are ſubdivided into ſuch as have a twining, and ſuch as have an

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erect ſtem. Kidney-bean is adduced as an example of the one; trefoil, melilot, reſt-harrow and fenugreek of the other. The twenty-third claſs contains plants which have their ſeeds contained in a capſule or dry ſeed-veſſel, and flowers compoſed of five petals. Theſe are ſubdivided from the diſpoſition of the leaves, which in ſome, as carnation, lychnis, and St. John's wort, ſtand oppoſite in pairs; in others, as purſlane, ſaxifrage and winter-green, are placed alternately, or without any order upon the ſtalk. Dillenius inſtituted a new claſs, to be placed immediately after the twenty-third, conſiſting of capſule-bearing plants which have ſix or more petals. To this diviſion are referred water-purſlane, purple willow-herb and water-lilly.

The firſt grand diviſion of flower-bearing herbs being exhauſted, we proceed to the ſecond, which includes all herbaceous plants having one ſeed-lobe, or that riſe with a ſingle ſeed-leaf. This diviſion contains but two claſſes, and is ſubdivided, like the former, from the preſence and abſence of the petals. The twenty-fourth claſs conſiſts of plants which have a ſingle ſeed-lobe or ſeminal leaf; flowers compoſed either of ſix petals, or of one deeply cut into ſix ſegments; and a capſule or dry ſeed-veſſel divided internally into three cavities or cells. Theſe are the liliaceous or bulbous-rooted plants, which, beſides the characters juſt mentioned, have generally ſimple, graſſy, ſword-ſhaped leaves that are perfectly entire. In his original method, as likewiſe in his Hiſtory of Plants, publiſhed in 1686, Mr. Ray diſtributed the plants in queſtion into two claſſes, by the names of *bulboſæ*, and *bulboſis affines*, that is, bulbous-rooted herbs, and ſuch as bear an affinity to them. As ſome plants, however, which manifeſtly pertain to this claſs, would be excluded, by adopting the form of the root for the claſſical diſtinction, he has very properly rejected it in his improved method for that more ſyſtema-

tical character derived from the nature and internal diviſions of the ſeed-veſſel. Some ſpecies of Iris have a bulbous, ſome a tuberous, ſome a fibrous root. The genus certainly belongs to the claſs under review, yet could not have all its ſpecies referred to it, if the form of the root was made the claſſical diſtinction. Again, a ſpecies of ranunculus with a bulbous root, and ſome other herbs which manifeſtly belong to very different claſſes, would arrange themſelves with the liliaceous plants, if, in diſcriminating this diviſion of the method, the form of the ſeed-veſſel had not been ſubſtituted for that of the root. Indeed, as the claſs now ſtands, there are ſome bulbous-rooted plants referred to it which have not the claſſical character, a capſule divided into three cells. Such are orchis, ladies ſlipper, bee-flower, and limodorum, whoſe ſeed-veſſel or capſule has properly an undivided cavity. Mr. Ray, in his improved method, ſubdivides the liliaceous flowers into three ſections. The firſt contains ſuch as have a ſingle petal divided at the brim into ſix ſegments, as hyacinth, aſphodel, meadow-ſaffron, crocus, narciſſus, iris and aloe: in the ſecond are three diſtinct petals, of which flower-of-a-day, ſometimes called Virginian Spider-wort, is the only example: and in the third are contained plants with ſix diſtinct petals, as lilly, tulip, ſtar of Bethlehem, Guernſey-lilly, and crown-imperial. The twenty-fifth claſs contains the graſſes, which, in the method under review, ſtand diſtinguiſhed from the liliaceous plants, by the abſence of the petals. Their other characters are, a cylindrical, jointed and generally hollow ſtalk; ſeveral ſlender, undivided, pointed leaves, which proceed ſingly from the joints, and are ranged alternately; and a ſingle naked ſeed under each flower. This claſs is ſubdivided into ſuch as bear larger ſeeds, as wheat, rye, oats, and the other kinds of corn, which furniſh food to man; and into the graſſes properly ſo called, which have a leſſer grain, and are the principal nouriſhment of other animals. Ruſh, cy-

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preſs-graſs, burr-reed, and a few other plants which have an affinity to the graſſes, are referred to a ſeparate ſection. The twenty-ſixth claſs ſerves as an appendix to the firſt part of the method, and conſiſts of ſuch herbaceous plants as do not properly arrange themſelves under any of the foregoing claſſes. This diviſion was expunged by Dillenius, who has diſtributed all the Britiſh plants pertaining to it among thoſe claſſes in the method to which they ſeemed to have the greateſt affinity.

We come now to ſubdivide trees and ſhrubs, which are primarily diſtinguiſhed, like herbaceous plants, from the number of ſeed-lobes or ſeminal leaves. The curious tribe of palms are the only trees that have a ſingle ſeed-lobe. Theſe, therefore, ſingly conſtitute the twenty-ſeventh claſs, which, from the reſemblance of the leaves of the plants in queſtion to thoſe of reeds, has obtained the name of *Arundinaceæ*. Of trees which riſe with two ſeminal leaves, ſome have the flower placed at a diſtance from the fruit, either on the ſame or different plants, obtained from the ſame ſeed; whilſt others have the flower and fruit placed contiguous. The twenty-eighth claſs conſiſts entirely of trees of the former deſcription. In theſe plants, the fruit is either hard, dry, ſcaly, and formed into a cone, as in fir, pine, cypreſs, and *arbor vitæ*; dry, but not ſcaly, nor cone-ſhaped, as in box; or of the nature of a berry or nut, as in juniper, yew, mulberry, walnut, hazel and oak. Trees which have the flower contiguous to the fruit, are arranged under the four following claſſes. Theſe are primarily ſubdivided from the ſituation of the flower, which, in ſome, ſtands upon the top of the fruit, and, in others, ſurrounds it or coheres to its baſe. In ſuch as have the flower ſeated upon the fruit, the calix is permanent, and, after the fall of the flower and conſequent ſwelling of the ſeed-bud, forms in the fruit at the end oppoſite to the footſtalk a cavity which, from its

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reſemblance to a navel, has obtained among botaniſts the name of *Umbilicus*. The plants of the twenty-ninth claſs have all an umbilicated fruit, and that either of the apple or berry kind, as pomegranate, pear, quince, medlar, roſe, gooſeberry, ivy, viburnum and elder. In the three following claſſes, the flower ſurrounds the fruit or coheres to its baſe, ſo that no *umbilicus* or cavity can be formed by the calix. The thirtieth claſs contains trees which, beſides the common character juſt mentioned, have always a pulpy fruit, either of the cherry, berry or apple kind. It is exemplified in plumb, almond, apricot, peach, miſletoe, mock-privet, jeſſamy, arbutus, orange, cuſtard-apple and calabaſh. In the thirty-firſt claſs, the ſeed-veſſel is dry, but not of the pod kind. In the thirty-ſecond, the plants are leguminous, that is, bear pods, and have generally a papilionaceous or butterfly-ſhaped flower. Elm, maple, aſh, lime and mock orange, arrange themſelves under the former; tamarind, acacia, broom and coronilla with many others, under the latter. There remains only one claſs, the thirty-third, which ſerves, in ſome ſort, as an appendix to this part of the method, as the twenty-ſixth does to the diviſion of herbaceous plants. It contains only one genus, the fig, which differs from all other trees in having the flower concealed within the fruit.

Thus have I, with conſiderable labour, toiled through the numerous claſſes of this complex and highly intricate method of arrangement. Were I to pronounce with impartiality of its merits and defects, I ſhould not ſcruple to aſſert, that, however beautiful in the idea, neither the plan nor execution is, in any degree, calculated to facilitate the knowledge of plants. In fact, it ſeems to have been Ray's great object, no leſs than that of Moriſon, to collect as many natural claſſes as poſſible; and theſe being ſeparately inveſtigated, a multiplicity of characters and ſteps

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was neceſſarily required to connect them. Hence the intricacy complained of, which muſt always exiſt, where the claſſes give riſe to the connecting characters, not the characters to the claſſes. Eminent as is the rank of this author in the liſt of botanical writers, ſeveral inſtances could be adduced in which the execuion is inferior even to the plan, and vegetables are erroneouſly referred to particular branches of the method. In anatomizing the claſſes, I had occaſion to mention ſome improprieties of this kind. The following, not hitherto recorded, deſerve attention. Agrimony has two naked ſeeds that are lodged in the bottom of the calix, yet is referred by Ray to the tenth claſs, which, as the reader will obſerve, contains plants whoſe flowers are ſucceeded by a ſingle naked ſeed. To the ſame claſs are referred fumatory and meadow-rue; although the former is furniſhed with a ſeed-veſſel, and the latter has many naked ſeeds inſtead of one. The diſtinction from the number of ſeed-leaves, however proper in detecting the order of nature, or connecting aſſemblages that have been already detected, is of all others the moſt unſatisfactory in conducting to the knowledge of plants. An herbaceous vegetable is preſented to me which I am to inveſtigate by the method juſt illuſtrated. My firſt enquiry is, whether the plant riſes with one or two ſeed-leaves? The queſtion appears ſimple and eaſy; and yet it is a thouſand to one that I am incapacitated by circumſtances from returning a proper anſwer. For, if the plant has paſſed, though never ſo little, its firſt ſtage of vegetation, ſo that the expanſions of the lobes of the ſeed are no longer viſible, in vain do I look for a ſolution of my query, till its ripened ſeeds have, in germinating, protruded one or two ſeminal leaves ſimilar to thoſe exhibited by itſelf in the infancy of its progreſs. Thus the preſence of both flower and fruit is, in the firſt inſtance, of no avail; and the number of ſeed-leaves muſt abſolutely be recognized, before the plant can be referred to its primary diviſion

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in the method: I ſay, its primary diviſion, becauſe many ſubordinate characters paſs under review previous to the determination of its claſs. The number of ſeed-leaves conſtitutes the firſt diviſion; the preſence or abſence of the petals, the ſecond; the ſimplicity or compoſition of the flowers, the third; the preſence or abſence of a veſſel for containing the ſeeds, the fourth; the number of naked ſeeds, the fifth; the nature of the ſeed-veſſel, the ſixth; the number of petals, the ſeventh. Encumbered with ſuch a multiplicity of characters, many of them not accurately determined, how is it poſſible that the method ſhould be uſeful? As an attempt to inveſtigate the order of nature, its merit is great and conſpicuous. The firſt, third, fourth, ſixth, eleventh, twelfth, thirteenth, fourteenth, ſixteenth, twenty-firſt, twenty-ſecond, and twenty-fifth claſſes, are true natural aſſemblages. In fine, to ſuch as are already maſters of the ſcience of plants, no plan of arrangement affords equal pleaſure with that of Ray. The order of nature, where it could be traced, is carefully pointed out; and the affinities of plants delineated with a maſterly hand. To beauties of this kind the novice in Botany is inſenſible; he requires an eaſy method of inveſtigating plants, and, provided he obtains it, is totally indifferent whether the claſſes are natural or artificial.

The characters of the orders or ſecondary diviſions in Ray's method are no leſs multifarious than thoſe of the claſſes. They reſpect the place of growth of plants, their qualities, the figure of the ſtem, the number, ſituation, ſubſtance and diviſion of the leaves, the ſituation and diſpoſition of the flowers and calix, the number and regularity of the petals, the number and figure of the fruit. In his improved method, Ray has adopted Tournefort's characters of the genera, wherever his plan would permit. His General Hiſtory of Plants contains deſcriptions of 18655 ſpecies

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and varieties. The third volume, which was not publiſhed till 1704, and is deſigned as a ſupplement to the two preceding ones, contains the plants diſcovered by Tournefort in the Levant, and by Camelli at Luzon, one of the Philippine Iſlands. Ray's method was followed by Sir Hans Sloane in his Natural Hiſtory of Jamaica; by Petiver in his Britiſh Herbal; by Dillenius in his Synopſis of Britiſh Plants; and by Martyn in his Catalogue of Plants that grow in the neighbourhood of Cambridge.

To Ray's original method ſucceeded that of Chriſtopher Knaut, a German, which acknowledges the ſame principle, and is manifeſtly founded upon it. In his Enumeration of the plants that grow naturally around Hal in Saxony, publiſhed at Leipſic in 1687, the few vegetables he deſcribes are arranged into ſeventeen claſſes which have for their baſis, the ſize and duration of plants, the preſence or abſence of the petals, the diſpoſition of the flowers, the ſubſtance of the fruit, the number of capſules or ſeeds, the number and figure of the petals, and the preſence, abſence or figure of the calix. After the uſual diſtribution of vegetables into herbs and trees, Knaut proceeds to diſcriminate the former, from the preſence and abſence of the petals. Herbs that are furniſhed with petals he again ſubdivides into ſuch as bear ſimple, and ſuch as bear compound flowers. The former arrange themſelves into nine claſſes, which ſtand diſtinguiſhed by the preſence or abſence of a veſſel for containing the ſeeds. In plants of the firſt claſs, the ſeeds are incloſed in a fleſhy ſucculent veſſel of the berry kind, of which arum, bryony and night-ſhade afford proper examples; in the ſeven claſſes which immediately ſucceed, the caſe or veſſel is dry and membranaceous. The ſecond claſs contains plants with a ſingle capſule or dry ſeed-veſſel, and one petal; and is exemplified in fumitory, gentian, fox-glove, convolvulus and birth-wort. Four regular petals characterize the third claſs, as do four

irregular petals the fourth, which correſpond to the twenty-firſt and twenty-ſecond claſſes of Ray. The fifth, ſixth and ſeventh claſſes contain plants with five, ſix and many petals, and anſwer to the twenty-third and twenty-fourth claſſes of the ſame author. Plants with more than a ſingle capſule conſtitute the eighth claſs, which is exemplified in ſwallow-wort, columbine, aconite, pæony and hellebore, and correſponds to the eighteenth claſs of Ray. All plants having naked ſeeds or wanting a ſeed-veſſel are contained in Knaut's ninth claſs, which conſequently includes the umbelliferous and rough-leaved plants, thoſe with leaves diſpoſed in the form of a radiant ſtar, the lip-flowers and ſeveral others. The compound flowers, which conſtitute the two next claſſes are diſtinguiſhed from the preſence or abſence of the *pappus* or downy crown of the ſeed. In the tenth claſs, which is exemplified in daiſy, feverfew, tanſy, ſcabious, teazel and eryngo, the ſeeds are ſolid, that is, want the crown alluded to; in the eleventh, of which after, golden-rod, groundſel, thiſtle, dandelion and nipple-wort furniſh examples, they are crowned with a *pappus* or downy calix. The preceding claſſes exhauſt the diſtribution of herbaceous plants that are furniſhed with petals. In the four following claſſes, which conclude the firſt diviſion of the method, the petals are wanting; and that either ſolely, as in the twelfth and thirteenth, which are exemplified in hop, nettle, mercury, dock and the graſſes; or in conjunction with the calix, as in the fourteenth and fifteenth, which correſpond to the four firſt claſſes in Ray's method; the former containing the ferns; the latter, the moſſes, muſhrooms and ſea-weed. It remains only to be obſerved that woody vegetables, which conſtitute the ſecond grand diviſion, are very unſyſtematically huddled together, as in Ray's original method, into two claſſes, the one including trees, the other ſhrubs.

Such is the general method of Chriſtopher Knaut, which Linnæus very properly terms Ray's original Syſtem inverted. Trees are placed after herbaceous vegetables, petal-wanting herbs after ſuch as are furniſhed with petals, plants with naked ſeeds after ſuch as have the ſeeds contained in a caſe or veſſel, plants with many dry membranaceous ſeed-veſſels after ſuch as are only furniſhed with one, and compound flowers after thoſe which are ſimple. The diſtinction from the lobes of the ſeed Knaut has entirely rejected; as he has likewiſe that of flower-bearing and flower-wanting herbs. On the whole, however, his method is not a whit eaſier or more practicable than that of Ray: the uncertain diſtinction of petal-bearing and petal-wanting flowers is ſtill retained; a multiplicity of ſteps is employed in connecting the claſſes; and if the author has diminiſhed the number of theſe, by thruſting ſeveral into the place of one, he has likewiſe rendered them doubly intricate, by making a variety of ſubdiviſions neceſſary. Plants which bear naked ſeeds occupy ſix claſſes in Ray's improved method: in the method under review they are all referred to one. Much, it may be thought, is gained here in point of facility. A plant with one, two, four or many naked ſeeds is referred at ſight to the ninth claſs in Knaut's method. But although its place in the arrangement is ſo quickly determined, I am not a whit nearer in inveſtigating the plant. For, upon examination, I find, that the ſections or ſubdiviſions of the claſs in queſtion exactly correſpond to the claſſes containing plants with naked ſeeds in Ray's method: ſo that 'tis only ſubſtituting the term *diviſion* for *claſs*, and *claſs* for *ſection* or *ſubdiviſion*, and the two methods are, in this reſpect, exactly the ſame. Thus Knaut, by abridging Ray's method, has neither removed its difficulties, nor rendered it leſs impracticable. The faults of his arrangement, however, are not merely negative. He has entirely effaced the beauty of his original, and deſtroyed its

ſymmetry. The natural claſſes, which conſtitute the chief, perhaps the ſole merit of Ray's ſyſtem, find no place in that of Knaut; and in their ſtead we are preſented with claſſes, which do not compenſate for the want of numerous relations, by poſſeſſing any ſuperior facility in conducting to the knowledge of plants. There is no certain mark of diſtinction betwixt the twelfth and thirteenth claſſes, which contain herbaceous plants that want petals, but have the flower-cup. The fourteenth and fifteenth, which include all the flower-wanting herbs of Ray, are not more accurately diſtinguiſhed. In fine, the copy is greatly inferior to the original, and, indeed, poſſeſſes no great ſhare of merit, either in point of execution or utility.

The ſections or ſubdiviſions of the claſſes in Knaut's method are ſixty-two in number, and ariſe from the figure of the ſtem and petals, the number of capſules and cells, their figure, the number of ſeeds and leaves, and ſituation of the flowers.

Doctor Herman's method, which comes now to be analyſed, is formed, partly on that of Moriſon, partly on that of Ray, and affords as beautiful diſtinctions as any mode of diſtribution hitherto invented. Its author, profeſſor of Botany at Leyden, was the firſt who introduced into Holland a genuine ſyſtematic arrangement of plants from the parts of fructification. Moriſon's method had been left incompleat; and Ray's, though perfect from its firſt appearance, did not all at once attract the attention of the learned, and was indeed for many years ſtudied chiefly in England, the native country of its author. The defects of Ray's original method, and its impracticability, did not elude the obſervation of Herman. He had applied himſelf with unremitting ardour from his earlieſt years to the ſtudy of plants, had examined with attention every plan of arrangement, and actually undertaken

taken a long and perilous expedition into India, with the ſole view of promoting his favourite ſcience. Such a man merited the applauſe of the public, and he obtained it. He was recalled from his expedition, and appointed to ſuperintend the botanical ſchool and garden at Leyden: in the diſcharge of which important office, he exhibited ſuch marks of unwearied diligence, that twice as many plants are ſaid to have been reared by Herman alone, as had been introduced into the garden by all his predeceſſors put together, Bontius, Clutius, Pavius, Cluſius, Vorſtius, Schuylius, and Syenus, in the long ſpace of a hundred and fifty years. Boerhaave relates, that, in 1681, the number of plants in the garden at Leyden amounted to only one thouſand five hundred and thirty-ſeven; and that eight years after they had increaſed, by the induſtry of Herman, to the amazing number of three thouſand and upwards.

THE method propoſed by Herman was firſt publiſhed to the world in 1696, by Zumbac, who arranged according to it the plants demonſtrated by its celebrated author in the public garden. Rudbeckius the younger, in a Diſſertation publiſhed the ſame year on the fundamental knowledge of plants, has adopted Herman's method with a few inconſiderable variations. Laſtly, in 1695, Herman himſelf, fully convinced of the neceſſity of emendations in the primary as well as ſubaltern diviſions, ſet about an accurate edition of his method, in which he had made a very conſiderable progreſs, when death put a final period both to him and his work.

HERMAN'S method conſiſts of twenty-five claſſes, which are founded upon the ſize and duration of plants, the preſence or abſence of the petals and calix, the number of capſules, cells and naked ſeeds, the ſubſtance of the leaves and fruit, the form and con-

conſiſtence of the roots, the ſituation and diſpoſition of the flowers, leaves and calix, and figure of the fruit. After diſtributing all vegetables into herbs and trees, the author proceeds with Knaut to arrange the former into two diviſions, from the preſence or abſence of the petals. Petal-bearing herbs conſtitute the firſt diviſion, and are contained in eighteen claſſes, which ſtand diſtinguiſhed by the abſence or preſence of a veſſel for containing the ſeeds. The firſt ſeven claſſes exhauſt the diviſion of herbaceous plants with naked ſeeds. In the firſt are contained plants whoſe flowers are ſucceeded by ſeveral naked ſeeds that are joined together and form a head. It correſponds to the fifteenth claſs in Ray, and is exemplified in ranunculus and meadow-rue. The umbelliferous plants conſtitute the ſecond claſs, the characteriſtics of which are, two naked ſeeds, and flowers of five petals formed into an umbel. The third and fourth claſſes agree in having a ſingle naked ſeed, but differ in the nature of the flowers, which are ſimple in the former, compound in the latter. This diſtinction has been fully explained already. The fifth claſs, which ſhould have immediately ſucceeded the ſecond, contains plants that have two naked ſeeds, and flowers with one petal. Theſe are the *ſtellatæ* or *ſtar-like* plants of Ray. Four naked ſeeds characterize the two next claſſes, which contain the rough-leaved plants and ſuch as flower at the joints, of the ſame author. Of plants which have their ſeeds contained in a veſſel, ſome bear a membranaceous, ſome a pulpy ſucculent fruit. Membranaceous ſeed-veſſels are either of the capſule or pod kind. Plants with a ſingle capſule are divided from the form of the roots, which, in ſome, are bulbous, in others, not bulbous. Thoſe which arrange themſelves under the latter diviſion are again ſubdivided from the number of cells, caverns or internal cavities of the ſeed-veſſel. In the eighth claſs, the fruit has one cell, in other words, an undivided cavity; in the ninth, there are two cells, in the tenth three,

three, in the eleventh four, in the twelfth, five or more. The bulbous-rooted plants, which conſtitute the twenty-fourth claſs in Ray's method, are very improperly disjoined by Herman from the diviſion to which they belong, and transferred to the ſixteenth claſs, where they are perfectly ſolitary, and maintain no ſort of connection with any of the plants in their neighbourhood. Herbs with many capſules are all contained in the thirteenth claſs which correſponds to the eighteenth in Ray. The fourteenth and fifteenth claſſes contain plants with a dry membranaceous ſeed-veſſel of the pod kind; the former includes the croſs-ſhaped, the latter the butter-fly-ſhaped or pea-bloom flowers of later botaniſts. Herbs with a pulpy fruit form the ſeventeenth and eighteenth claſſes, which ſtand diſtinguiſhed, as in Ray, from the covering of the pulp, which, in the former, is thin and ſlender, in the latter, coarſe and thick.

Such are the diſtinctions of petal-bearing herbs adopted by Herman. Herbs which want petals are contained in the three following claſſes, and arrange themſelves, as in Knaut, from the abſence of that organ alone, or of both calix and petals. The nineteenth claſs conſiſts of herbaceous plants which want the petals, but are furniſhed with a flower-cup properly ſo called. It is exemplified in rhubarb, dock, ſpinach, and plantain. In the twentieth claſs, which contains the ferns, and ſome herbaceous plants, whoſe flowers grow in catkins, both calix and petals are wanting. The twenty-firſt includes the graſſes, and ſuch plants as have an affinity to them. They are diſtinguiſhed from thoſe of the two preceding claſſes, by the preſence of a *gluma* or huſky calix. In Knaut's method, the graſſes are very improperly thruſt into a claſs with plants to which they have no affinity: ſo that an accurate characteriſtical mark cannot be aſſigned for diſcriminating the two claſſes of plants that want the petals. In the method

method under review, the graſſes being aſſigned a ſeparate claſs, are accurately diſtinguiſhed from all other plants that want petals, by the nature of their flower-cup, which is of that kind termed a *gluma* or huſk; whilſt the preſence of a cup, without reſpect to its nature, ſerves effectually to diſtinguiſh them from the ferns, moſſes, and ſuch other plants as have neither calix nor petals.

In ſubdividing trees and ſhrubs, Herman has greatly improved upon Ray. The twenty-ſecond claſs conſiſts of trees whoſe flowers want petals and grow in catkins. It correſponds to the twenty-eighth claſs in Ray's method, the plants of which, as the reader will remember, have the flower placed at a diſtance from the fruit. To this claſs Herman has referred the tribe of palms, which occupy a whole diviſion in Ray. Trees with a pulpy umbilicated fruit conſtitute the twenty-third claſs, under which is arranged the fig, by Ray placed in the appendix to his method, from its ſingularity in concealing the flowers within the fruit. The twenty-fourth claſs conſiſts of trees with pulpy fruits which are ſupported, not crowned by the calix: the twenty-fifth of ſuch as have a dry membranaceous ſeed-veſſel. The former correſponds to the thirtieth; the latter to the thirty-firſt and thirty-ſecond claſſes in Ray's method, which improperly disjoined trees with dry ſeed-veſſels of the pod kind from ſuch as have a dry membranaceous fruit of another form.

By attending to the analyſis juſt given, the reader cannot fail to obſerve, that the method propoſed by Herman excels all which preceded it, in the uniformity of its claſſical characters. The author ſet out with the fruit for his principle, and has adhered more cloſely to it than either Moriſon, Ray or Knaut. In the firſt eighteen claſſes, the number of naked ſeeds, the nature of the different ſeed-veſſels, and the number of cells or internal cavities

cavities of the fruit furniſh the ſole diſtinction. No ſuch uniformity characterizes the methods of the ſyſtematical writers juſt mentioned. Ray and Knaut have ſubdivided that branch of their reſpective methods which contains plants having a dry membranaceous ſeed-veſſel, from the number of petals; Herman from the number of cells or cavities of the fruit. The tranſition from the ſeed-veſſel to the petals is unnatural, becauſe the latter precede the former: the tranſition from the ſeed-veſſel to its internal diviſions is in the true ſpirit of ſyſtematic arrangement, which, attaching itſelf to one particular part, is ſtudious to exhibit it, for the purpoſe of diſcriminating bodies, under every poſſible point of view. Herman's ſuperiority in this reſpect is indiſputable. Even the diſtinction of ſimple and compound flowers he has rendered ſubordinate to the principle with which his method ſets out, and, inſtead of employing it, as Ray and Knaut have done, in diſcriminating all flower-bearing plants that are furniſhed with petals, has reſtricted it to the diſtinguiſhing of two claſſes, thoſe, to wit, containing plants whoſe flowers are ſucceeded by a ſingle naked ſeed. But though, by this improvement, Herman has rendered his method more uniform, he has added nothing to its facility. In fact, the number of naked ſeeds is a very equivocal character when employed in diſtinguiſhing compound flowers, which we may as properly arrange with Cæſalpinus among plants that bear many naked ſeeds, as with Herman among ſuch as bear but one; the former reſpecting the aggregate, the latter, each particular floret of which it is compoſed.

The diſtinction of naked and covered ſeeds makes a very principal figure in all the methods founded upon the fruit, particularly in thoſe of Ray, Knaut, and Herman. Yet, ſtrange as it may ſeem, there is no characteriſtical mark that, in all caſes, ſhall, with accuracy, diſtinguiſh the one from the other. Whatever,

when ripe, detaches itſelf from the mother-plant ſpontaneouſly and ſingly, is denominated by Mr. Ray a naked ſeed. He adds that, in dubious caſes, we are always to be determined by the ſtructure of the plants of the ſame natural claſs. Thus, continues my author, in leguminous plants with a ſingle ſeed, and ſome others that bear ſmall pods of the *ſiliqua* kind, the fruit falls off from the parent plant without ſplitting, and diſperſing the incloſed ſeeds. Yet is not the whole ſubſtance ſo detached to be deemed a naked ſeed; why? becauſe moſt of the plants which have neareſt affinity to thoſe in queſtion are confeſſedly furniſhed with a ſeed-veſſel that is either replete with numerous ſeeds, or, if it contains but one, is found to open ſpontaneouſly, when ripe, with a view to expel it. The truth of this concluſion I allow, but deny its utility. A novice in Botany, and it is to ſuch an one that every plan of arrangement ought to accommodate itſelf, will be little benefited by the diſtinction juſt mentioned. His object is to inveſtigate plants by a method of arrangement, the principles of which he comprehends. He underſtands the terms *naked* and *covered* ſeeds, in the general ſenſe expreſſed in their definition; he expects that the meaning of words ſhould never be violated; that they ſhould, at firſt, be defined with a logical exactneſs, nor be ever made to convey any other ſenſe than that with which they were originally impreſſed. He is ſuppoſed to be totally ignorant, not of the plant in queſtion only, but of all ſuch as bear affinity to it: how then, in doubtful caſes, ſhall Mr. Ray's rule be applied? He is to be determined by the plants of the ſame natural claſs; but thoſe plants are unknown to him: he muſt depend then entirely upon the rectitude of the definition, which, as we have ſeen, is evidently calculated to bewilder and miſlead. I decline ſtretching this criticiſm to its utmoſt extent, and ſhall only obſerve that, as no characteriſtical mark has hitherto been aſcertained, which, in all caſes, ſhall diſcriminate *naked* from

covered

covered ſeeds, the diſtinction, far from having infallibility aſcribed to it, ought, in my opinion, to be employed with no leſs reſerve than that derived from the preſence or abſence of the petals. An ingenious botaniſt of the preſent century, whoſe tenets I ſhall have occaſion in the ſequel to diſcuſs, has not ſcrupled to deny the exiſtence of naked ſeeds, and of conſequence, the reality of the diſtinction before us. I will not at preſent enter largely into the merits of this paradoxical dogma, which I am clearly of opinion owed its origin to miſtaken notions of the analogy that ſubſiſts between plants and animals. Seed-veſſels or receptacles of the ſeeds are in the vegetable kingdom what the *uterus* of vipiparous animals, is in the animal. The ſeeds contained in the caſe or veſſel correſpond to the fœtus incloſed in the *uterus*. Perhaps, the author juſt alluded to, may have extended the analogy to oviparous animals, and even to ſuch in which the proceſs of generation is leſs accurately diſcerned. His mode of reaſoning then has probably been as follows: ſeed-veſſels are confeſſedly analogous to the *uterus* of animals; now all animals are furniſhed with an *uterus*, or ſome organ which performs its functions; therefore all plants are furniſhed with a ſeed-veſſel for incloſing and nouriſhing the vegetable fœtus. This propoſition, however, is not logically true, becauſe neither the major nor minor have been demonſtrated ſuch. Indeed, if the analogy contended for could be fully proved, and all animals demonſtrated to be furniſhed with an *uterus*, I ſhould think the conſequence infallibly certain: but as neither of theſe has been attempted, and both major and minor are entirely hypothetical, the ſyllogiſm is falſe, and the concluſion or inference erroneous. That the analogy does not hold good in every caſe, is indiſputable. I ſhall allow that the ſeed-veſſels of plants which gape and expel the ſeeds, may be thought analogous to the *uterus* of viviparous animals: and the ſeeds ſo expelled with their proper teguments to the

animal fœtus that is protruded with its coverings. But is this analogy univerſal? Do the ſeed-veſſels of all plants ſplit when ripe, for the purpoſe of expelling their ſeeds? The contrary is indubitable. Pulpy fruits of the apple, berry and cherry kind neither ſplit when ripe, nor adhere to the plant, as the uterus always does to the animal, but detach themſelves from it with the incloſed ſeeds. Again, ſeed-veſſels which ſplit when ripe, and adhere to the plant after the diſperſion of their ſeeds, ceaſe to be uſeful in vegetation. They are temporary parts deſtined to incloſe and expel the ſeeds. Their nature admits not of a ſecond fecundation; they have been once fruitful; they have expelled their ſeeds; the end of their deſtination is accompliſhed; they wither, moulder and rot. How ſtriking the diſparity in animals! The female *uterus* is no temporary part, nor limited to a ſingle fecundation. It is coeval, ſubſiſts and dies, with the animal; and is deſtined to perform, not once, but frequently, its valuable functions of incloſing and nouriſhing the tender fœtus.

From this digreſſion, which the main ſubject afforded me, I return to mention ſome improprieties committed by Herman in the execution of his plan. The firſt ſeven claſſes contain plants with one or more naked ſeeds: but inſtead of beginning with the moſt ſimple, and proceeding to the more complex, Herman ſcarce obſerves any order in their arrangement, ſave that ſuggeſted by the conveniency of demonſtration. Plants with many naked ſeeds occupy the firſt claſs, becauſe they produce their flowers very early in the ſpring. Next come the umbelliferous plants, which bear two naked ſeeds; then the ſimple and compound flowers with one; to theſe ſucceed the plants with leaves diſpoſed like a radiant ſtar, which, like the umbelliferous plants, bear two; and laſtly, the rough-leaved plants and ſuch as flower at the joints, whoſe characteriſtic is four naked ſeeds. Rudbeckius,

beckius, in his edition of Herman's method, has removed the impropriety complained of, by beginning with the moſt ſimple claſſes, thoſe, to wit, whoſe plants bear a ſingle naked ſeed, and proceeding by degrees to ſuch as are more complex, that is, have plants with two, four or many ſeeds. With the plants of the firſt claſs, Herman, after Ray, has improperly arranged thoſe of the mallow tribe, which producing, not a number of naked ſeeds, but a capſular fruit divided into ſeveral cells, ought unqueſtionably to be referred to the twelfth claſs, with the characteriſtics of which the plants in queſtion agree. Scarce any of the plants of the third claſs, which correſponds to the tenth of Ray, are found to poſſeſs the claſſical character, a ſingle naked ſeed. In all the ſpecies of valerian, the flower is ſucceeded by a ſtreaked capſule, which in ſome is leſs conſpicuous, in others, thick and hard as a cruſt; and, in a particular ſpecies, furniſhed with two cells, one of which is generally empty. Marvel of Peru has its ſingle ſeed covered with a huſk or outer coat, which may be eaſily ſtripped off, if not over-dried. Enchanter's night-ſhade is furniſhed with a capſule that has two cells, each containing a ſingle ſeed. Fumatory has a ſmall undivided pod of the *ſiliqua* kind; agrimony two naked ſeeds lodged in the bottom of the calix. Some of the other claſſes with naked ſeeds are liable to exceptions of the like kind. What Herman and Ray denominate two naked ſeeds in the plants whoſe leaves are diſpoſed in the form of a ſtar, Linnæus, with much greater propriety, terms a twinberry of a dry ſubſtance, incloſing two ſeeds. Looſe-ſtrife has a capſular fruit with an undivided cavity, and therefore ought not to be arranged with the plants of the ninth claſs, the characteriſtic of which is a capſule with two internal diviſions or cells. Gentian, leſſer centaury and ſaxifrage, are to be excluded for the ſame reaſon. Some ſpecies of hypericum have one, ſome two, ſome five cells; yet are they all placed without diſtinction in

Herman's

Herman's tenth claſs, which includes ſuch capſular fruits as are divided internally into three cavities or cells. To the ſame claſs are improperly referred the violet, cardinal flower, and ſheep-ſcabious, the firſt of which has an undivided cavity, the others, a capſule with two cells. Graſs of Parnaſſus has one cell, winter-green five, and aſarabacca ſix. In fact, except greek valerian, rampions, and bind-weed, there are none of the plants in the tenth claſs that agree in the general character; nor thoſe always neither; the fruit of bind-weed being ſometimes entire or undivided within. Thorn-apple and rue are referred to the eleventh claſs, which contains capſular fruits with four cells, altho' the former has always two, and the latter, except in one ſpecies, always five cells. Poppy and prickly poppy have an undivided cavity, and therefore do not pertain to the twelfth claſs, the fruits of which are divided into five or more cells. Many more improprieties of a ſimilar nature might be mentioned; but I forbear entering farther into the merits of the method before us, becauſe the inſtances already given are ſufficient to evince, that the execution is greatly inferior to the plan.

The claſſes in Herman's method are ſubdivided into eighty-two ſections or orders, which have for their baſis the number of petals, ſeeds, capſules and cells, the figure of the ſeeds and petals, and diſpoſition of the flowers. The ſecond, fifth, ſixth and ſeventh claſſes are true natural families.

Our review of methods founded on the fruit cloſes with that of the celebrated Dr. Herman Boerhaave, who, ſucceeding to the botanical chair at Leyden in 1709, ſpared no endeavours to preſerve among his countrymen that love for the ſcience of plants which his predeceſſor, Herman, had happily introduced. His method is that of Herman, combined with part of the methods

of

of Tournefort and Ray. The ſubmarine and imperfect plants, which find no place in the ſyſtem of Herman, are borrowed by Boerhaave from that of Ray. To collect as many natural claſſes as poſſible, he has likewiſe adopted the diſtinction firſt ſuggeſted by the ſame author from the number of ſeed-lobes or ſeminal leaves. The compound flowers form four claſſes, which derive their characters partly from Ray, partly from Tournefort. Laſtly, trees are diſtributed, as in the latter writer, from the flower, not as in Ray and Herman, from the fruit. It deſerves to be remarked, that Boerhaave, to avoid confuſion, has claſſed all trees and ſhrubs which bear butter-fly-ſhaped flowers with ſuch herbaceous plants as have flowers of the ſame figure. Tournefort, by retaining the ancient diſtinction into herbs and trees, and characteriſing both by the figure of the petals, has been led to inſtitute ſeveral claſſes which, agreeing with others both in the general character and title, ought to be excluded as ſuperfluous. In Boerhaave's method, which is founded partly on the fruit, partly on the flower, an agreement of characters in different claſſes was leſs to be apprehended. The pea-bloom flowers, in fact, appeared to the author the only plants from whoſe ſeparation could ariſe claſſes with ſimilar characters. He has therefore preſerved the family entire, and arranged the papilionaceous trees with the papilionaceous herbs. For my own part, I cannot approve of this junction, as I profeſs myſelf inſenſible of the danger which the ingenious author was ſo ſtudious to avoid. Herbaceous plants with a pea-bloom flower are arranged by Boerhaave after Herman and Ray, not from the figure of the flower, but from the nature of the fruit, which is that kind of pod termed a *legumen*. Trees then with pea-bloom flowers might have formed another claſs, the characteriſtic of which being the figure of the flower, and not the ſubſtance or figure of the fruit, rendered it impoſſible to confound the plants in queſtion with thoſe of the herbaceous

kind

kind juſt mentioned. Upon the whole, Boerhaave ought either to have rejected the diſtinction into herbs and trees altogether, or to have retained it entire. By placing leguminous trees in the ſame claſs with leguminous herbs, he has diſcovered a want of attention to the main purpoſe of ſyſtematic arrangement, and precipitately encountered a real danger, in order to avoid an imaginary inconvenience.

BOERHAAVE's claſſes are thirty-four in number, and ſubdivide themſelves into a hundred and four ſections, which have for their characters, the figure of the leaves, ſtem, calix, petals and ſeeds; the number of petals, ſeeds and capſules; the ſubſtance of the leaves; the ſituation of the flowers and their difference in point of ſex. By this method Boerhaave arranged near ſix thouſand plants, the produce of the botanical garden at Leyden, which he carefully ſuperintended for the ſpace of twenty years, and left to his ſucceſſor, Dr. Adrien Royen, in a much more flouriſhing ſtate than he had himſelf received it. His Index or Catalogue of the Leyden plants was publiſhed in octavo in 1710, and afterwards, with great additions, in quarto in 1720. This laſt edition contains deſcriptions of five thouſand, ſix hundred and fifty plants, of which number upwards of two thirds had been introduced into the garden ſince the time of Herman, by the induſtry of his illuſtrious ſucceſſor. Boerhaave's characters are derived from the habit or general appearance of plants combined with all the parts of fructification; ſo that, as Linnæus very properly obſerves, he was the firſt who employed the calix, ſtamina and ſtyle in determining the genus. About ſeventeen new genera were eſtabliſhed by this author; among others, the very ſplendid family of the *protea* and ſilver-tree, which, although partly deſcribed by Moriſon, had remained generally unknown till the period now under review. His method was adopted by one Ernſting,

Ernſting, a German, in a treatiſe entitled, The firſt Principles of Botany, publiſhed in octavo, at Wolfenbuttel, in 1748. To detect the order of nature, not to diſcover an eaſy plan of arrangement, ſeems to have been the darling object of Boerhaave; in attaining which, however, he has been ſo little ſucceſsful, that, of the four-and-thirty claſſes which compoſe his difficult and complicated method, no more than eight can be reckoned true natural aſſemblages. Theſe are the claſſes containing the ferns; the umbelliferous and rough-leaved plants; thoſe which flower at the joints and have leaves diſpoſed at proper intervals round the ſtem in form of a radiant ſtar; the croſs-ſhaped and pea-bloom flowers; and the diviſion of compound flowers with flat petals, and a lacteſcent or milky ſtalk. The other claſſes are purely artificial, and contain plants which, not poſſeſſing numerous relations, are approximated only by their agreement in the ſingle mark that characterizes the claſs.

The inconveniencies which attend every mode of arrangement founded upon the fruit have already been mentioned: and if the reader has carefully peruſed the preceding part of this ſection, he will not only readily acknowledge their exiſtence, but be apt to wonder that with imperfections, ſuch as thoſe I have recorded, a ſeries of methods ſhould have continued in eſtimation ſo long. In fact, to the writers, whoſe works we have been examining, the novice in Botany is little obliged. Solicitous to collect the affinities of plants, to inveſtigate the order of nature, and diſcriminate her numerous aſſemblages, they forgot that the main purpoſe of ſyſtem is to facilitate to others the knowledge of the objects about which it is converſant. To maſters of the ſcience their reſearches afford the higheſt intellectual entertainment: whilſt to the beginning botaniſt they are equally ſparing of information and delight. The rage which ſo long ſubſiſted

for diſcovering the philoſopher's ſtone proved beneficial to chemiſtry, by caſually enriching it with ſeveral valuable diſcoveries; the paſſion for inveſtigating a natural method in Botany was productive of a quite contrary effect, and had well nigh annihilated the ſcience which it was meant to aggrandize and improve. Blinded by the prevailing prejudice, each ſucceeding writer adopted the errors of his predeceſſor; and no one could be found poſſeſſed of ſufficient courage to venture upon an unbeaten path, even if genius had adminiſtered the proper aſſiſtance in pointing it out. Each walked in the track marked out for him by another. Moriſon followed Cæſalpinus; Ray improved upon Moriſon; Knaut abridged Ray; Herman formed himſelf partly on Moriſon, partly on Ray; Boerhaave makes Herman his guide, and calls in Ray and Tournefort as auxiliaries. Auguſtus Quirinus Rivinus, a German, Profeſſor of Botany at Leipſic, was the firſt who, in 1690, relinquiſhing the purſuit of affinities, and convinced of the inſufficiency of the fruit, ſet about a method which ſhould atone, by its facility, for the want of numerous relations, and natural families. A method purely artificial appeared to Rivinus the beſt adapted for the purpoſe of vegetable arrangement. He ſaw in all their magnitude the imperfections of thoſe methods which, ſetting out with the profeſſed deſign of detecting the order of nature, had accompliſhed but half their aim. He reſolved to profit by the errors of his predeceſſors, not blindly to adopt them; and rejecting the fruit which had proved an inſufficient principle, and the ſource of numberleſs imperfections, he attached himſelf to the flower, which he was ſenſible furniſhed characters no leſs numerous, permanent and conſpicuous than thoſe of the fruit. In the methods that have been already analyſed, the reader will have obſerved that the ſeed-veſſel and ſeeds, the two conſtituent parts of the fruit, were employed in conjunction. Perhaps either does not furniſh ſufficient variety of characters to

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ſerve ſingly as the foundation of a method. Be that as it may, the parts of the flower lie under no imputation of this kind. The calix, petals, ſtamina and ſtyle or pointal, which conſtitute the flower, are each ſufficiently diverſified in point of number, figure, proportion and ſituation to ſerve as the baſis of a mode of arrangement; yet all are not equally proper for that purpoſe. Rivinus made choice of the petals as the largeſt and moſt beautiful part, and that from which the flower itſelf is vulgarly characterized. His method conſiſts of eighteen claſſes, which have for their baſis the perfection and diſpoſition of the flowers, and regularity and number of the petals.

As Rivinus ſet out with the profeſſed deſign of imparting facility to Botany, he judged very properly in diveſting his method of all extraneous matter, and rendering it as ſimple and uniform as the nature of the ſcience would admit. The diſtinction into herbs and trees had been adopted by every writer on plants ſince the time of Ariſtotle. Rendered, in ſome meaſure, ſacred, by its antiquity, it long maintained a conſequence which had better befitted characters leſs inſufficient, and more clearly aſcertained. Rivinus was the firſt who in this matter dared to think for himſelf; he was early ſenſible of the inconveniencies to which thoſe had ſubmitted who employed it as a primary diviſion; he reſolved therefore at once to get rid of a diſtinction that is frequently uncertain, always deſtructive of uniformity, and in its nature repugnant to the genuine ſpirit of ſyſtem, becauſe totally unconnected with the parts of fructification. His reaſons for this laudable, but unprecedented ſtep, he has delivered with great preciſion in a letter addreſſed to Mr. Ray, ſoon after the publication of his method, in which likewiſe the propriety of the aforeſaid diſtinction is fully handled.

The method now before us opens with a diviſion from the preſence of the petals and calix, and abſence of either or both. Flowers that are furniſhed with both the organs in queſtion, are ſaid, in the language of Rivinus, to be perfect or compleat; thoſe which want either or both are denominated imperfect or incompleat. This diſtinction was formerly hinted at, and its ſuperiority above that derived from the preſence or abſence of the petals alone fully proved. Perfect flowers, which occupy the firſt ſeventeen claſſes, are ſubdivided into a double phalanx, the one containing ſimple, the other compound flowers. It would be unneceſſary to enlarge upon this diſtinction, as the reader who has peruſed Ray's method with attention, will be at no loſs for its diſcriminating character. Simple flowers ſubdivide themſelves into ſuch as are regular, and ſuch as are irregular. Regular flowers are defined by Junigus, Ray and Chriſtian Knaut, to be ſuch whoſe petals agree, not ſo much in magnitude, as in figure and ſituation. Rivinus's idea is different. The petals, or diviſions of the petal, if there is but one, muſt correſpond not in figure and ſituation only, but alſo in ſize; in one word, they muſt be every way equal. Nor is this all. Other characters are required to be preſent, in order to conſtitute the flower ſtrictly regular. The ſtyle is to iſſue from the center of the flower; the calix to have its diviſions equal, and the ſtamina to be proportionable in number to the petals or their diviſions. This firſt part of the method then forms two branches, which are each ſubdivided from the number of petals into ſeven claſſes that have the ſame characters and title, and differ only in the equality or inequality of the flowers. We begin with the regular flowers, which occupy the firſt ſeven claſſes. Plants of the firſt claſs have regular flowers of one petal. It is exemplified in marvel of Peru, madder, borrage, hound's-tongue, mallow, hyacinth, water-leaf and ſwallow-wort. The ſecond claſs contains only one genus, enchanter's night-ſhade, which bears regular

gular flowers with two petals. Flowering-ruſh, frog's-bit and water-plantain, afford examples of the third claſs, whoſe characteriſtic is three regular petals. The fourth and fifth claſſes are numerous, and contain plants with four and five regular petals. Poppy, barren-wort and the croſs-ſhaped flowers arrange themſelves under the former; ſaxifrage, ranunculus, myrtle, columbine, with ſeveral others under the latter. The ſixth claſs conſiſts of flowers with ſix regular petals, and is exemplified in moſt of the liliaceous or bulbous-rooted plants. More petals than ſix, and a regular flower characterize the ſeventh claſs, of which adonis, anemone and ficoides afford proper examples. The irregular flowers with one petal are exemplified in ſage, roſemary and the other lip-flowers. Thoſe with four petals are the papilionaceous or pea-bloom flowers of later botaniſts. The umbelliferous plants with ſome others, particularly aconite, lark-ſpur, violet and fraxinella occupy the claſs containing flowers with five irregular petals. Irregular flowers with ſix petals are exemplified in orchis, ladies-ſlipper and honey-flower. The claſſes deſtined for containing plants with irregular flowers of three and many petals, were inſerted in order to render the plan of arrangement compleat: for neither Rivinus, nor Heucher, who publiſhed the greateſt part of his method, were acquainted with any plants that could arrange themſelves under either of theſe claſſes. Two genera only pertain to the claſs of irregular flowers with two petals. The compound flowers are very improperly interjected by Rivinus betwixt the regular and irregular ſimple flowers, and occupy three claſſes, which ſtand diſtinguiſhed from the regularity and irregularity of the florets of which the aggregate is compoſed. In the firſt claſs, which is the eighth of the method, the florets are all regular and equal. Globe-thiſtle, globe-amaranth, centaury, burdock, eryngo and water-lilly are adduced as examples. This claſs correſponds to part of the *capitatæ* of Ray,

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and to the compound flowers with hollow florets of Tournefort. The ſecond claſs is compoſed of florets that are partly regular partly irregular, and is exemplified in ſun-flower, daiſy, and the other radiated flowers of the French botaniſt, which have hollow regular florets in the center or diſk, and flat irregular ones in the circumference, margin or ray. In the third claſs, the florets are all of an irregular figure, being hollow at the baſe, and flat above. The plants which compoſe it correſpond to the compound flowers with flat petals and a milky ſtalk of Ray, and to thoſe with ſemi-florets of Tournefort. There remains but one claſs, the eighteenth, containing all the plants by Rivinus termed imperfect, that is, which have none or only one of the covers preſent. Theſe are the cone-bearing plants, thoſe whoſe flowers grow in catkins, the graſſes, the ferns, moſſes, muſhrooms and ſome others.

Such is the ſyſtem of Rivinus from the equality and number of the petals: a ſyſtem, no leſs admired for its ſimplicity, than for the regularity and uniformity of its plan. Its facility in conducting to the knowledge of plants will beſt appear by an example. I am required to refer a plant of the common mallow to its proper claſs in Rivinus's method. The preſence of both calix and petals excludes it at once from the eighteenth claſs, the characteriſtic of which is the abſence of one or both. My next enquiry is, whether the plant in queſtion pertains to the diviſion of ſimple or compound flowers? This, from my knowledge of the diſtinctive character, is immediately anſwered, and the plant referred at ſight to the former branch of the method. By this ſtep the three claſſes containing compound flowers are cut off, and my plant is adjudged to belong to one of the fourteen claſſes of the perfect, ſimple flowers which remain. I next examine the diviſions of the flower, and finding them to be equal, not only in ſituation and figure, but alſo in ſize, I refer the plant to the

the diviſion containing regular flowers, which occupy the firſt ſeven claſſes of the method. The number of petals next claims my attention: and here I muſt be particularly cautious not to confound plants of one claſs with thoſe of another. For it frequently happens that flowers with only one petal are ſo deeply divided, that to a careleſs or ſuperficial obſerver they appear compoſed of many petals. Rivinus's rule on this head is in general a good one. It is to reckon as many petals, as the flower reſolves itſelf into, when fallen. The reader, however, is not to imagine, that in every caſe we are to wait for this criterion. It is only meant as a guide where the diviſions of the flower are ſo deep that a doubt may well ariſe to what branch of the method the plant in queſtion ſhould be referred. In moſt caſes, we can determine at ſight whether the flower is compoſed of one or more petals. If the diviſions only reach the middle of the flower, or occupy the upper ſpreading part, without extending to the tube or hollow part below, there is no doubt, the flower is manifeſtly of one petal, and arranges accordingly. If, on the other hand, the diviſions reach the bottom of the flower, and do not adhere, even in the ſlighteſt degree, but appear each, by their ſimilar conformation, to be totally diſtinct, and actually reſolve themſelves, on the falling of the flower, into as many ſeparate parts as there were diviſions when it remained upon the plant, the flower is manifeſtly compoſed of many petals, and muſt be referred to its correſponding diviſion in the method. The former characters are generally ſufficient to determine this: it is only, as we have ſaid, in doubtful caſes, that Rivinus's rule is to be applied. Neither indeed is the rule in queſtion infallible: for though by it ſeveral plants, particularly wood-ſorrel, ledum, pimpernel and *trientalis*, are very properly adjudged to have but one petal, from the diviſions being found to adhere, in falling off; yet ſhould we commit a manifeſt impropriety by referring to a claſs with

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four petals the flowers of *vaccinium oxycoccus*, which, however, reſolve themſelves, on falling off the plant, into four diſtinct leaves. I am not even certain, whether in the example before us, which has furniſhed matter of controverſy on this head, the rule juſt mentioned can determine with preciſion. Rivinus and Tournefort arrange plants of the mallow tribe with ſuch as bear flowers of one petal. Linnæus, in his *Genera Plantarum*, has aſſigned to each five diſtinct petals. For my own part, I muſt confeſs that I lean to the opinion of the two former botaniſts, not only becauſe I could produce ſeveral inſtances of flowers confeſſedly of one petal, in which the ſegments or diviſions are equally deep with theſe of the mallow tribe; but alſo becauſe the ſegments are rounded, not pointed at the baſe, where they likewiſe manifeſtly cohere. Since I am upon this ſubject, I cannot help remarking a very beautiful diſtinction between flowers of one and many petals, not known to Rivinus. It ariſes from the ſituation of the ſtamina, which, in flowers of more petals than one, are inſerted into the receptacle or ſummit of the footſtalk; in thoſe of one, into ſome part of the petal. M. Vaillant, an ingenious French academician, was the firſt who made this obſervation, ſo far as it reſpects flowers of one petal: and Pontedera is ſaid to have diſſected two thouſand different ſpecies with a view to eſtabliſh its univerſality. By this rule, the flowers of *trientalis* and wood-ſorrel are determined to have only one petal, although the diviſions, which are ſeven in the former, and five in the latter, cohere ſo ſlightly at the baſe, that, without ſuch a mark of diſtinction as that I have mentioned, we ſhould be at a loſs whether to arrange the plants in queſtion, at ſight, with ſuch as bear flowers of one or more petals. I do not, however, mean to inſinuate that Pontedera's rule is a whit more infallible than that of Rivinus. On the contrary, I am ſenſible that, like every general rule, it admits of exceptions; and that it were equally raſh to conclude every flower

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monopetalous which has the ſtamina attached to it, as to arrange among ſuch as have more petals than one all flowers that, in detaching themſelves from the plant, are reſolved into two, three, four or more diſtinct pieces. In ſea-pink, and the genus *melanthium*, the ſtamina are inſerted into the petals, which are five in the former, ſix in the latter. Lychnis, ſilene, roſe-campion, and ſome others of Linnæus's natural order, *caryophyllæi*, have the ſtamina alternately inſerted into the claws of the petals, which are five in number. In theſe plants the number of ſtamina is ten; ſo that one half is attached to the receptacle or ſeat of the flower, and the other half to the petals. Again, there are inſtances of flowers with one petal, which have not the ſtamina attached to their ſubſtance. Of this kind are aloe, and *ciſſus*; as alſo azalea, arbutus, *ledum*, andromeda, heath, and the other flowers of Linnæus's natural order, *bicornes*, ſo termed from the *antheræ* or tops of the ſtamina exhibiting an appearance like two horns. To return to the illuſtration of Rivinus's method. The reaſons mentioned above having determined me to regard the flowers of mallow as monopetalous, that is, compoſed of a ſingle petal, its place among the ſimple regular flowers no longer remains a ſecret. Theſe occupy, as we have ſaid, the firſt ſeven claſſes, which ſtand diſtinguiſhed from the number of petals. To the ſecond, third, fourth, fifth, ſixth and ſeventh my plant cannot be referred, becauſe in theſe the characteriſtic is two or more petals. There remains only the firſt claſs, which conſiſting of regular flowers with one petal, muſt conſequently include the plants of the mallow-tribe, whoſe flowers we have ſhewn to be perfect, ſimple, regular, and monopetalous.

It has been ſaid that Rivinus's method, ſimple and uniform as it is, muſt, if ſtrictly followed, be productive of an almoſt continual violence to nature, by disjoining things which were

never meant to be ſeparated, and confounding others which are in themſelves totally diſtinct. I am admoniſhed that not only different genera of the ſame natural claſs, but likewiſe different ſpecies of the ſame natural genus are exceedingly diverſified with reſpect to the regularity and number of the petals; and that, conſequently, characters derived from theſe circumſtances muſt be of all others the moſt improper, from their manifeſt tendency to confound. This concluſion I deny, yet allow the truth of the affirmation from which it is deduced. In methods purely artificial, the principal object is to arrange plants in an eaſy ſimple manner. Regardleſs of their affinities, ſuch methods are ſolicitous only to conduct with facility to their knowledge. Natural genera, no more than natural claſſes, muſt be preſerved entire, in direct contradiction to the principles of the method. Theſe are to be obſerved in all their rigour, or the great end of the arrangement is fruſtrated. In fact, natural genera exiſt not, but in a natural method. Every artificial method has its own proper genera, becauſe the principle varies in each. To attempt therefore, to mould the genera of a ſyſtem, profeſſedly artificial, after thoſe of a method not yet detected, and whoſe principles are totally different, is, in effect, not only to confound artificial methods with the natural, but to counteract the very end and intention of arrangement altogether. A genus is a ſubaltern diviſion in every method; it ſubdivides the ſection or order, in like manner as the order ſubdivides the claſs. Certain characters flowing from the genius of the method ſerve to diſcriminate each diviſion: the genus has its peculiar marks of diſtinction, by which, as by fixed laws, it is regulated and reſtrained. Can we then blame an author who, intent upon giving facility to his method, ſhall refuſe to incorporate plants of the ſame ſuppoſed natural claſs and genus, when ſuch junction cannot be effected without fruſtrating the arragement, and deſtroying its eſſence? Shall

Shall Rivinus be cenſured if, in a method founded upon the regularity and number of the petals, he has choſen to ſeparate regular flowers from the irregular, and plants with one petal from ſuch as have two or more, even although their agreement in the habit, and other characters, ſhould determine ſome of thoſe ſo ſeparated to belong to the ſame natural claſs? Had he acted otherwiſe, he would have confounded his artificial character with the natural, and rendered his method of no avail. I am not to learn, that the excellence of the artificial character conſiſts in its approximation to the natural; and that a method is undoubtedly rendered more valuable by the greater number of natural families which it collects. But ſtill the end of an arrangement is to be kept in view; and if a multitude of natural claſſes cannot be collected by an artificial character, without fruſtrating that end, and rendering the method impracticable, I am clearly of opinion that ſuch natural aſſemblages are to be abandoned without reſerve, and that character adopted which, by its facility, bids faireſt to be moſt extenſively uſeful. Rivinus, however, is not only cenſured for employing a character which admits not of natural claſſes; he has alſo been reprehended for neglecting to retain ſuch claſſes, although this he could not have done without infringing the fundamental laws of his method. Moſt of the liliaceous or bulbous-rooted plants have flowers compoſed of ſix regular petals: in a few, however, particularly hyacinth, crocus and narciſſus, the diviſions of the flower, which are ſix in number and equal, do not reach the bottom, and conſequently form but one piece. I leave it to the reader to judge whether Rivinus has not very properly ſeparated theſe different orders of the liliaceous plants, by arranging the latter with regular flowers of one petal; the former with ſuch as have ſix diſtinct petals. Had he acted otherwiſe, I ſhould have been the firſt to anathematize his method, as deſtitute of its only recommendation, facility. Again,

Rivinus is ſeverely cenſured by Ray for removing viper's bugloſs from the other rough-leaved plants, to which it is naturally allied. But here, as in the former inſtance, our author will be found perfectly in the right. Viper's bugloſs has a very irregular flower of one petal; comfrey, borrage, hound's-tongue and the other rough-leaved plants are furniſhed with regular flowers, which, in ſhape, reſemble either a bell, funnel or ſalver. Would a novice in Botany have reckoned himſelf obliged to Rivinus, if, ſolicitous to preſerve unbroken the natural order, he had arranged viper's bugloſs with its irregular flower among flowers confeſſedly regular? Rivinus was ſenſible of the impropriety of ſuch a meaſure, which he knew could not be adopted but in direct oppoſition to his own principles: he has therefore very wiſely avoided it, and transferred the genus in queſtion to that diviſion of the method containing irregular flowers of one petal, under which it naturally falls. His ſeparation of tormentil from cinquefoil has met with a ſimilar reprehenſion that is equally ill-founded. Tormentil has four equal petals, cinquefoil five. Would not Rivinus have merited cenſure, had he arranged theſe under one claſs? A perſon who turns over a dictionary expects to find the words arranged in an order ſtrictly alphabetical: the leaſt error in orthography, the ſlighteſt deviation from thoſe laws by which the compilation is agreed to be regulated, render the nomenclature, in thoſe particular inſtances, totally uſeleſs. It is juſt ſo with a botanical method. If it is agreed that all plants having the ſame number of regular petals ſhall be arranged under one claſs, in like manner as all words with the ſame initial letter occupy the ſame diviſion of a dictionary; would it not be highly abſurd, in direct oppoſition to ſuch agreement, to place flowers of four petals in the ſame claſs with ſuch as have five, or conjoin plants of one regular petal with ſuch as have ſix? The learner would no more dream of ſuch ridiculous junctions, than

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he who peruſes a dictionary expects to find the word BOTANY under the letter A. Other charges, of a ſimilar nature with thoſe already canvaſſed have been directed againſt our author by Ray, Blair, and the other lovers of affinities: but theſe I forbear mentioning, becauſe the reader muſt be convinced, from the inſtances already quoted, that the improprieties imputed by theſe writers to Rivinus, are, in fact, the beauties and perfection of his method. An author who adopts a principle, is obliged to adhere to it with the moſt ſcrupulous exactneſs. The leaſt deviation is an unpardonable error, becauſe calculated to miſlead. A convention is entered into by the author with the learner, and that convention he muſt religiouſly obſerve. The queſtion is not, whether the principle be more or leſs excellent: it has been adopted, and muſt either be rigidly adhered to, or totally abandoned. If a writer is convinced of the inſufficiency of his principle, let him adopt another, and new-mould his method accordingly: but let him never engraft one principle upon another; let the execution always correſpond to the plan.

I NOW proceed to mention imperfections of a different kind that have been imputed to this method, and which, if indeed they have an exiſtence, are chargeable, not upon the plan, but its execution. Some ſpecies of valerian have regular, ſome irregular flowers. Under what branch of Rivinus's method is the genus to be placed? if totally under the diviſion of regular or irregular flowers, a manifeſt impropriety is committed, becauſe the ſegments of the petal in ſome of the ſpecies are equal, in others, unequal: If partly under both, a violence is done to nature, and plants, to preſerve the credit of an artificial character, are forcibly torn from the ſociety of thoſe to which they are moſt nearly allied. Such is the argument of the opponents of this method, which I truſt to anſwer to the ſatisfaction of the reader. It proceeds

ceeds upon an implied ſuppoſition that genera are as fixed and invariable as ſpecies, than which nothing can be more falſe or hypothetical. In every artificial method the genera are different, becauſe the genus, in ſuch methods, is as arbitrary a diviſion as either the claſs or order. The principle of every artificial method is different; its claſſes are different; the genera therefore, which are only ſubaltern diviſions of the claſſes, muſt be different alſo. Is it not evident, that the ſame principle which new-models the claſs or primary diviſion, muſt operate in faſhioning the genus or ſubordinate one? If the genera were indeed fixed, as is pretended, artificial methods could be of no utility whatever: as all the ſpecies of ſuch genera would very rarely be found to arrange themſelves under their proper claſs and order. Moſt of the intricacies in the ſexual ſyſtem proceed from this ſource, as will afterwards be fully ſhewn. This being premiſed, I am ready to anſwer the queſtion that was propoſed above. To me, indeed, the alternative never appeared difficult, becauſe I am clearly of opinion that the principles of a method are to be obſerved in all their rigour, notwithſtanding any ſeeming inconveniencies with which ſo ſtrict an adherence may be attended. In a method founded upon the equality of the petals, all regular flowers naturally arrange themſelves under one diviſion, all irregular flowers under another. It is in vain that I am told of natural genera being ſplit by ſuch a mode of arrangement; I acknowledge no natural genera in an artificial method: I diſavow every genus that is independent of its claſs and order, and claims to be aſcertained without their aſſiſtance. As a ſubaltern diviſion, not of the claſs only, but alſo of the order, a genus muſt poſſeſs the diſtinguiſhing characters of both. For if the claſſical character is wanting, we miſtake the claſs: if that of the order, we miſtake the order: and it is evident, that if the plant is referred either to a wrong claſs or order, it can never be detected: the genus

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muſt always remain unknown. Perhaps few of the plants which now arrange as ſpecies of valerian were known to Rivinus; if they had, I make no doubt that he would have formed them into ſeveral genera, had the principles of his method required it. I ſhall only add, that if, in arranging the ſpecies which he confeſſedly knew he has, in any reſpect, violated thoſe principles, the fault ought ſolely to be imputed to the author, not to his plan. Again, the European ſpecies of Geranium being furniſhed with a regular flower, the African with an irregular, Rivinus has very properly formed them into two genera, by the names of *Gruinalis*, that is, crane's bill, and *Geranium*, which he has placed, one in the diviſion of regular, the other of irregular flowers. The author cannot be ſo well defended for placing all the umbelliferous plants in a claſs containing irregular flowers; many of them, and thoſe known to Rivinus, particularly lovage, hog's fennel, ſium, parſley, and herb-gerard, have five petals that are perfectly equal. Theſe, undoubtedly, ſhould have been transferred to the diviſion containing regular flowers, becauſe they do not poſſeſs the character of the diviſion in which they are placed. The lip-flowers occupy part of that claſs in Rivinus's method which is deſtined for containing plants with one irregular petal: yet may it be doubted whether mint, iron-wort and water horehound do not more properly fall under the diviſion containing regular flowers; as, in the plants in queſtion, the upper lip is ſcarce to be diſtinguiſhed from the lower, and the flower, at firſt ſight, appears to be divided into four equal parts. There is a manifeſt impropriety too in arranging with the irregular flowers of four petals ſuch pea-bloom flowers as have undoubtedly five. Of this kind are liquorice and broom, in which the keel or innermoſt part of the flower forms two diſtinct petals. Other papilionaceous flowers, not known to Rivinus, are found to conſiſt of five irregular petals. Such are *ſecuridaca*, coral tree, *borbonia*,

borbonia, furze, and *pſoralea*; in the firſt of which the ſtandard, in the reſt the keel, is divided into two parts that are totally diſtinct. Some ſpecies of trefoil have an irregular papilionaceous flower of one petal, the ſtandard, wings and keel being conjoined. It would therefore be highly improper to place theſe in Rivinus's method along with the other trefoils, which are furniſhed with four irregular petals. They ought, in conformity to the principles of the method, to form a ſeparate genus, and be transferred to the claſs containing irregular flowers of one petal. I do not much approve of fumatory and balſam being placed with the papilionaceous flowers. Chriſtian Knaut has judged better in transferring the former to the claſs of irregular flowers with two petals: and as to the latter, it has generally five irregular petals, and therefore ſhould be removed to the claſs which immediately ſucceeds. Some ſpecies of balſam, which want the two intermediate petals, are to be placed without reſerve in the claſs containing irregular flowers with three petals. With reſpect to the genus *ſtatice*, which has been urged againſt our author, becauſe a particular ſpecies, the *ſtatice monopetala* of Linnæus, bears flowers of one petal, whilſt the reſt have five equal petals, it is certain, that no ſpecies of *ſtatice* are mentioned either by Rivinus or Heucher; and, it is highly probable, if they had, that the ſpecies alluded to would have been removed to that diviſion of the method, whoſe claſſical character it poſſeſſes. In arranging the compound flowers, Rivinus has been guilty of a real impropriety. We have ſeen that Moriſon, Ray and Herman did not ſcruple to rank with the compound flowers, ſcabious, teazel, and a few other plants, which, though they do not abſolutely poſſeſs all the diſtinguiſhing characters of that tribe, yet are ſo approximated to it by their general appearance, that no great violence is done either to nature, or the principles of the method by combining them. The ſimple flowers which Rivinus has annexed

annexed to this tribe have not even the plea of affinity to offer. In fact, who would think of placing water-lilly, fennel-flower, and hellebore in the ſame claſs with the compound flowers? They poſſeſs no natural relations; nor do I believe that there exiſts an artificial character which could approximate them. Rivinus's principle of combination is no leſs ſtrange than the combination itſelf. Compound flowers, properly ſo called, he conſiders with Jungius as flowers that are naturally full; the ſimple flowers juſt mentioned, as flowers naturally double, and conſequently connected with the former, in the ſame manner as flowers that are rendered double by luxuriance of nouriſhment have a manifeſt affinity to ſuch as, from the different agency of the ſame cauſe, are rendered full. Our author's application of this very extraordinary principle will be beſt underſtood by an example. Yellow water-lilly has a flower-cup of five diſtinct pieces, within which are placed a number of petals in more than a ſingle row or ſeries. The flower-cup Rivinus reckons the outermoſt row of petals; and although its five leaves are diſſimilar to the internal petals, yet is each cover regular, conſidered in itſelf, becauſe its parts are ſimilar and equal. For theſe reaſons Rivinus has arranged the water-lilly with thoſe compound flowers, all whoſe florets are regular. It is deſcribed to have a regular flower of five petals in the circumference or ray, and one of many petals, likewiſe regular, in the center or diſk. Again, fennel-flower has five flat regular petals, within which are placed eight ſingular appearances, termed by Linnæus, *Nectaria*, each furniſhed with two lips. Rivinus arranges this plant with the radiated flowers of Tournefort, and aſſigns for his reaſon, that it is compoſed of a regular flower of five petals in the circumference, and of ſeveral irregular flowers of one petal in the center: the former correſponding to the real petals of the flower, the latter to the *nectaria*.

In the uniformity of its orders or ſecondary diviſions, which are ninety-one in number, and acknowledge the fruit for their principle, the method before us equals, perhaps excells, all that went before or ſucceeded it. Only three claſſes of his method were publiſhed by Rivinus himſelf. Theſe are the eleventh, fourteenth and fifteenth, which contain irregular flowers of one, four and five petals, and were given to the world at different times, illuſtrated with very ſplendid figures. The method was compleated and publiſhed entire by Heucher in a work entitled *Hortus Wittenbergenſis*, printed in quarto at Wittenberg in 1711.

Several German authors have followed Rivinus's method, either wholly or in part, without offering any conſiderable amendment. The principal of theſe are, Koenig, in a work on vegetables, publiſhed at Baſil in 1696; Welſch, in his *Baſis Botanica*, printed at Leipſic in octavo, in 1697; Gemeinhart, in a catalogue of plants publiſhed in 1725; Kramer, in a work entitled *Tentamen Botanicum*, publiſhed at Dreſden in 1728, and afterwards reprinted with additions at Vienna in 1744; and Hecker, in a diſſertation on Botany publiſhed at Hal in Saxony in 1734. To theſe may be added Hebenſtreit, an ingenious botaniſt, who, in a treatiſe on plants, publiſhed at Leipſic in 1731, juſt before his famous African expedition, eſtabliſhed generical characters, which had hitherto been wanting in Rivinus's method.

The writers who have affected to improve upon the method under review are Bernard Ruppius, Chriſtopher Ludwig and Chriſtian Knaut, likewiſe Germans. Of theſe in order.

Ruppius, in his *Flora Jenenſis*, publiſhed at Frankfort in 1718, has arranged the twelve hundred plants there deſcribed by a method,

a method, partly Rivinus's, and partly his own. It conſiſts of ſeventeen claſſes, and ſets out with the ſame diviſions and ſubdiviſions as that of his author, with this difference, however, that, whereas in Rivinus, all perfect flowers are divided into ſimple and compound; in Ruppius, the diviſion of regular and irregular flowers precedes that juſt mentioned, and ſimple and compound flowers are made ſubdiviſions of the regular flowers only. If Ruppius meant this as an improvement, he has certainly miſtaken his aim. By reſtricting the compound flowers to that diviſion of the method which includes regular flowers and none other, he has, in fact, aſſerted that all compound flowers are regular; an aſſertion in which he ſtands contradicted by the mereſt beginner; nay, even by himſelf: for, in the diſtribution of that tribe of plants, Ruppius's orders exactly correſpond to Rivinus's claſſes, and conſiſt of ſuch compound flowers whoſe florets are either all regular, all irregular, or compoſed of both. The fact is, that Rivinus led his imitator into the error complained of, by improperly interjecting the compound flowers betwixt the regular and irregular ſimple flowers. In Rivinus's method, the imperfect flowers are contained in one claſs; in that of Ruppius, they are parcelled out into three, one of which contains the graſſes, another, the cone-bearing plants, ſuch whoſe flowers grow in catkins, and a few others; and a third, the ferns, moſſes and muſhrooms, which want the flower altogether. Theſe claſſes, the reader will remember, correſpond to moſt of the ſections in Rivinus's ſingle claſs. Ruppius has judged wrong in excluding from his method the claſs containing irregular flowers with many petals; becauſe, although no plants were known to that author, no more than to Rivinus, that could arrange themſelves under ſuch claſs, yet plants of that deſcription might be afterwards diſcovered, and a method, to be univerſal, ought to accommodate itſelf no leſs to future diſcoveries than to thoſe

already made. In ſhort, the only real improvement which Ruppius has made upon Rivinus's method is in diſincumbering the compound flowers of ſcabious, teazel, eryngo, paſſion-flower, hellebore, fennel-flower, water-lilly and pine-apple, which Rivinus had very improperly thruſt into that tribe.

CHRISTOPHER Ludwig's method, which was publiſhed in 1737, and conſiſts of twenty claſſes, differs but little from that of Rivinus. The author accompanied Hebenſtreit on his expedition into Africa, and ſeems to have made plants his favourite ſtudy. I cannot, however, congratulate the learned reader on the improvements which Ludwig has pretended to make on Rivinus's plan. To me they appear not only uſeleſs but detrimental. Part of Rivinus's claſs, containing the imperfect flowers, is transferred to the diviſion of perfect or compleat flowers, and for that purpoſe theſe laſt are ſubdivided, from the preſence or abſence of the petals: the plants ſo transferred being deſcribed to be ſuch as want the petals, but are furniſhed with the flower-cup. This, as the reader will remember, is Ray's diſtinction revived, the inconveniencies of which need not be here repeated. Ludwig follows Ruppius in reſtricting the compound flowers to that diviſion of the method which contains plants with regular flowers, and in excluding Rivinus's claſs of irregular flowers with many petals. Like Ruppius, too, he diſtributes the imperfect flowers among three claſſes, which, however, do not exactly correſpond in both methods. The palms, graſſes and ſome other plants occupy the firſt; the cone-bearing plants, and thoſe whoſe flowers grow in catkins, the ſecond; the ferns, moſſes, muſhrooms, and ſubmarine plants, the third. In fine, Ludwig's method is only that of Rivinus rendered more univerſal; the author having enriched it with a multitude of genera, collected from the works of Tournefort, Ray, Boerhaave, Dillenius, and other eminent

eminent botaniſts, whoſe generical characters he has likewiſe adopted. His plan of arrangement has been followed by two ſucceeding writers: M. Wedel, in a botanical Eſſay, publiſhed in 1747; and three years after by M. Boehmer, in his Catalogue of the Plants which grow in the neighbourhood of Leipſic.

CHRISTIAN Knaut, although prior to both the writers juſt named, I have choſen to mention laſt, becauſe the plan of arrangement which he propoſed, is more properly his own, and departs in a much greater degree from the principles of Rivinus than that of either Ruppius or Ludwig. The regularity and number of the petals furniſhed, as we have ſeen, the claſſical diſtinctions in Rivinus's method; in that of Knaut, number takes place of regularity; ſo that it is very properly termed by Linnæus, the ſyſtem of Rivinus inverted. The method in queſtion, which conſiſts of ſeventeen claſſes, and was publiſhed at Leipſic in 1716, ſets out with a diviſion into flowers which have one petal, and ſuch as have more than one. Flowers with one petal occupy the firſt five claſſes, and are ſubdivided into ſimple and aggregate. Theſe laſt, the compound flowers of Rivinus, conſtitute the third, fourth and fifth claſſes, which ſtand diſtinguiſhed as in the original author. Simple flowers with one petal arrange themſelves in the firſt and ſecond claſſes, and are ſubdivided from the equality and inequality of the flower. The ſame character predominates in the ſeveral ſubdiviſions of the ſecond great branch of the method, that, to wit, containing flowers with more than one petal. Theſe ſubdiviſions are ſix in number, and conſiſt each of two claſſes, which, like the ſimple flowers with one petal, ſtand diſtinguiſhed by the regularity or irregularity of the flowers. The firſt phalanx of the grand diviſion alluded to contains flowers with two petals, and thoſe either

either regular or irregular; the ſecond, three; the third, four; the fourth, five; the fifth, ſix; the ſixth, many, or an indefinite number.

Such is the ſkeleton of Chriſtian Knaut's method, which, as the reader will obſerve, is incompleat, becauſe the plants with imperfect flowers, which form the eighteenth claſs of Rivinus, find no place in the ſyſtem of our author. It was Knaut's intention to remove this defect in a future edition of his work; but as far as I can learn, he never compleated his purpoſe. The ſections or ſecondary diviſions are an hundred and twenty-one in number, and depend upon the internal diviſions of the fruit. Upon this ſubject, the opinions of Knaut are ſomewhat ſingular. Every kind of fruit, whether pulpy or membranaceous, is denominated by our author a Capſule. Neither is this term reſtricted to fruits properly ſo called: it is extended alſo to thoſe termed by botaniſts, *naked ſeeds*, the exiſtence of which Knaut abſolutely denies. I formerly demonſtrated that this opinion proceeds upon miſtaken notions of the analogy ſubſiſting between plants and animals. Difficult as it certainly is to eſtabliſh a criterion which, in every caſe, ſhall, with accuracy, diſcriminate naked from covered ſeeds; it were highly abſurd to diſpute the reality of the diſtinction. I appeal to the reader whether he entertains any doubt that the umbelliferous plants, the compound and lip-flowers are furniſhed with true naked ſeeds; or, if he had rather adhere to Chriſtian Knaut's opinion, and denominate the fruits in queſtion, capſules with an undivided cavity, and a ſingle ſeed. Since I am upon this ſubject, it will not be improper to explain a few terms which occur in our author's method, and which, if underſtood, will greatly facilitate the knowledge of his ſecondary characters. It has been already mentioned, that every kind of fruit, whether properly or improperly ſo called, is termed by

Knaut

Knaut capſular. Capſules, with reſpect to their conſiſtence or ſubſtance, are of two ſorts, pulpy or ſucculent and membranaceous. The former correſpond to the fruits of the apple, berry and cherry kind; the latter to the capſules properly ſo called, and naked ſeeds of other botaniſts. Again, with reſpect to their cells or internal diviſions, Capſules are either ſimple or compound. Simple Capſules have an undivided cavity or a ſingle cell; compound capſules are internally divided into two or more cells. With other botaniſts, the umbelliferous plants bear two, the lip flowers four, naked ſeeds; according to Knaut, the former produce two ſimple capſules, the latter, four. Ranunculus, adonis, anemony, herb-bennet, and ſome other plants have their flowers ſucceeded by a number of naked ſeeds collected into an aggregate or head. Each of theſe ſeeds paſſes with Knaut for a ſimple Capſule; ſo that the whole is an aggregate of ſeveral capſules with an undivided cavity or ſingle cell. In numbering the cells or internal diviſions of the pulpy fruits, our author has adopted a very ſingular mode of calculation. Some fruits of the apple kind incloſe a capſule that is divided into five membranaceous cells. Might we not then very reaſonably expect to find ſuch fruits arranged with compound capſules of five cells? In vain, however, would be our moſt unwearied ſearch in that quarter. The author whimſically enough combines in their arrangement the idea both of a ſimple and compound capſule. The pulpy part is undivided, in other words, it is a ſimple capſule furniſhed with one cell; the compound capſule incloſed contains five cells, which added to that of the pulp make the number ſix; and with compound capſules of ſix cells are the fruits in queſtion made to arrange. It is by the ſame paradoxical reaſoning, that the fruit of dogwood which is of the cherry kind, and contains a ſtone with two cells or cavities, is placed by Knaut among compound capſules with three

three cells; the pulp paſſing for one diviſion, the cavities of the ſtone or nut for the remaining two.

SINGULAR as is this mode of calculation, it is not the only paradox which our author has been accuſed of maintaining. The eſſence of the flower is made by Ray, Tournefort, Rivinus and moſt botaniſts to conſiſt in the ſtamina and ſtyle. This poſition Knaut abſolutely denies, and has eſtabliſhed for a principle, that the flower is eſſentially conſtituted by the petals only. The flower-cup, ſtamina and ſtyle are of little ſignificance with Knaut; their preſence does not conſtitute a flower, if the petals are wanting; neither is their abſence ſufficient to deſtroy its exiſtence, if the petals are preſent. From this propoſition two corollaries are evidently deducible. The one, that a flower without petals is a ſoleciſm in Botany; the other, that the regularity and irregularity of the flower can never depend on the ſtamina and ſtyle, which are only occaſionally preſent, and in no wiſe eſſential to its exiſtence. It were unneceſſary to obſerve on theſe doctrines; their fallacy muſt be obvious to every reader.

I CLOSE my review of Knaut's tenets and method of arrangement with the examination of an heretical aphoriſm laid down by that author reſpecting his diſtribution of the genera. To be qualified for pronouncing of its merits, we muſt have accurate and preciſe ideas upon the ſubject; and theſe can in no way ſo certainly be obtained, as by an enquiry into the nature of that particular member of a method denominated a genus. In every artificial plan of arangement, the claſſical character is arbitrary, and depends upon a ſingle circumſtance. The orders or ſecondary diviſions are ſubdiviſions of the claſs; each order therefore, beſides its own proper character, poſſeſſes the common character of the claſs, of which it is a ſubdiviſion. As orders ſubdivide the

the claſs, genera ſubdivide the order: each genus, therefore, whilſt it poſſeſſes the common characters of the claſs and order, muſt ſtand diſtinguiſhed from all of the ſame order, by means of ſome character that is proper and peculiar to itſelf. The ſubdiviſions of a genus are termed ſpecies, each of which muſt conſequently agree in the common characters of the claſs, order and genus, and be diſtinguiſhed from its congeners by the poſſeſſion of a character that is properly its own. Such is the real ſtate of the ſubordination that ought to be obſerved betwixt the ſeveral parts or members of an artificial method. As ſtriking characters, however, cannot be found for diſcriminating every genus, it has been thought neceſſary, in default of ſuch eſſential marks, to call in the aſſiſtance of various parts of the plant, that the characters thence derived might attone, by their number, for the want of notoriety. The parts of fructification ſeemed, of all others, the moſt proper for this purpoſe. Theſe had, ever ſince the time of Geſner, furniſhed the ſole claſſical diſtinctions; and it was that author who firſt ſuggeſted their utility in diſcriminating the genera. In every orthodox method, the common generical characters muſt be founded on the parts of fructification, becauſe the genera are only ſubdiviſions of the claſs and order which acknowledge thoſe parts for their principle of diſtribution. For this reaſon, it appeared to Geſner highly proper that the diſcriminating character of genera, no leſs than that of claſſes and orders, ſhould be derived from the parts of the flower and fruit. It is in very few caſes, however, that a ſingle diſtinctive generical character will ſuffice. What then is the moſt eligible way of diſcriminating the genera, where conſpicuous and eſſential characters are wanting? To call in the aid of a multiplicity of characters, and ſubſtitute many in the place of one. It has furniſhed matter of controverſy to botaniſts, whether ſuch

characters ſhould be ſolely derived from the parts of fructification, from a combination of theſe and the other parts of the plant, or occaſionally only from the latter. Tournefort, the firſt who realized Geſner's idea reſpecting the diſtribution of the genera, never fails to have recourſe to the other parts when thoſe of the flower and fruit prove inſufficient. But it is only in caſes where their aſſiſtance cannot be diſpenſed with, that Tournefort has thought proper to employ the parts in queſtion. His primary genera, or genera of the firſt order, agree only in the parts of fructification; his ſubaltern genera, or thoſe of the ſecond order, call in the other parts of the plant as auxiliaries. Linnæus has adopted the principle of Geſner in all its rigour; and lays it down as an aphoriſm in no caſe to be departed from, that generical characters are to be derived from all the parts of fructification, and from none other. The habit or general appearance of plants, the various modes of flowering, the ſtructure of the root, ſtem and other parts unconnected with fructification, are employed in furniſhing generical diſtinctions by a third ſet of writers, in combination with the parts of the flower and fruit. With botaniſts of this claſs, Chriſtian Knaut is properly to be ranked, although the aphoriſm to be examined is, perhaps, peculiar to himſelf. The deſcription of a genus, according to Linnæus, is an enumeration of all the parts and modifications of the flower and fruit of the plants which compoſe it. Theſe parts too, ought, in ſtrict propriety, to be exactly the ſame in all the different ſpecies: as a genus is conſtituted by the agreements of a number of ſpecies in the parts of fructification. But two ſpecies are very rarely to be found that agree in all the organs of the flower and fruit, and their ſeveral modifications. It is with ſome latitude, therefore, that we are to underſtand the term genus; for if, to conſtitute ſuch an aſſemblage, it were neceſſary that the parts of the flower and fruit of the ſeveral ſpecies be in every

reſpect

reſpect ſimilar, the very end of the diviſion is fruſtrated, and genera are reſolved into mere ſpecies. This poſition, however, abſurd as it muſt appear, has had its abettors, and is, in fact, the very aphoriſm which I have been preparing the reader to confute. It is a maxim with Knaut, that the minuteſt difference in any of the parts of fructification in two different ſpecies is ſufficient to juſtify a ſeparation of ſuch ſpecies under different genera; nay, that it is abſolutely unſyſtematical to place plants with four petals in the ſame genus with ſuch as have five, or fruits of three cells with ſuch as have four. It has juſt been hinted, that a rigorous obſervance of this rule would occaſion an unneceſſary multiplication of genera, or rather indeed annihilate genera altogether, by confounding them with ſpecies, which are properly their component or conſtituent parts. But with whatever zeal I am inclined to oppoſe a dogma ſo big with abſurdity, and which, if ſtrictly followed, muſt ſap the very foundations of the ſcience, I would by no means wiſh to have it inculcated that, in the diſtribution of genera, too great latitude cannot be uſed. The enormous weight of genera is, in fact, no leſs prejudicial to Botany on the one hand, than the unneceſſary multiplication of their number is on the other. To avoid either extreme ought to be the care of every ſyſtematic writer, who cannot be too often reminded that the ſcience is in equal danger from both. Let it be remembered likewiſe that genera, to be perfect, muſt accommodate themſelves to the principles of the method under which they arrange. This rule muſt be inviolably obſerved; it admits of no exception whatever; the ſlighteſt deviation is attended with unavoidable confuſion. If genera through all their ſpecies do not invariably poſſeſs the common characters of the claſs and order of which they are ſubdiviſions, by what rule ſhall they be inveſtigated? In a method founded upon the number of petals, we ſhould never dream of looking for

genera with flowers of five petals in the ſame claſs with ſuch as have ſix; neither, for the ſame reaſon, ſhould we expect to find a different number of petals in the different ſpecies of the ſame genus. Again, if the orders or ſecondary diviſions derive their characteriſtical diſtinctions from the parts of the fruit, it is obvious, that the fruit of all the ſpecies of each genus muſt agree in that particular mark which characteriſes the order. Fruits of four cells are very improperly placed in the ſame order with ſuch as have five; and that whether the whole genus, or a particular ſpecies only, is deficient in the character of its reſpective order. If the former, the genus muſt be totally transferred to an order whoſe character it poſſeſſes; if the latter, it is reſolved into two diſtinct genera which arrange themſelves under ſeparate orders. Upon the whole, though I entirely diſapprove of Knaut's maxim, and can diſcern every bad conſequence with which its moſt rigorous obſervance would be attended, I cannot help thinking it entitled to ſome ſhare of indulgence, when it is conſidered that the author has been moſt probably betrayed into this error by a laudable deſire of accommodating the genera to the principles of his method. This opinion I am the rather inclined to adopt, as, in propoſing the aphoriſm in queſtion, our author has particularized the circumſtance of number, which furniſhes both his claſſical and ſecondary characters; the former being derived from the number of petals, the latter from the number of cells or internal diviſions of the fruit.

We are now arrived at the moſt important æra in the hiſtory of Botany. Here therefore the reader will not be diſpleaſed to ſtop with me for a moment, whilſt I briefly recapitulate the ſubject of the foregoing ſheets. It was the profeſſed intention of this prefatory View to trace Botanical knowledge through the various ſtages of its progreſs, to diſtinguiſh artificial methods from

from the natural, and point out the reſpective excellencies of each, to eſtabliſh orthodox doctrines reſpecting the diſtribution of the genera, to illuſtrate, analyſe and compare the various plans that have been imagined for arranging vegetables; in fine, to render Botany a ſcience of eaſy attainment, by removing the obſtacles that have retarded its progreſs. In the proſecution of this plan, I have hitherto endeavoured to expreſs myſelf with as much preciſion and perſpicuity as the nature of the ſcience and our language would admit. The artificial methods that have been analyſed are thoſe of Cæſalpinus, Moriſon, Ray, Chriſtopher Knaut, Herman, Boerhaave, Rivinus, Ruppius, Ludwig and Chriſtian Knaut: the four laſt from the number of petals, the reſt from the ſubſtance, number and figure of the fruit. Partial attachments to particular ſyſtems are totally unbecoming the gravity of a philoſophical diſcuſſion; I have therefore carefully avoided laviſhing praiſe where I could not impreſs conviction of its being properly beſtowed. It is for the ſame reaſon that, whilſt I have ſtudied to do juſtice to the merits of each ſyſtematic writer, who has hitherto paſſed under review, I have held forth none as infallible or void of imperfection. The man who, in matters of ſcience, wilfully conceals the errors of another adopts them as his own. Upon this principle, I have ventured in a few controverted points to differ from ſome diſtinguiſhed names in Botany. For the fate of ſuch criticiſms, however, I am in no wiſe ſolicitous. By the blindly partial they will perhaps be condemned without a hearing; by the man of candour and ingenuity they can ſcarce fail of being treated with reſpect, in honour of the principle which gave them exiſtence. I, for my own part, glory in aſſerting the right of free enquiry; I diſclaim a ſlaviſh attachment to any ſect or ſyſtem, however eminent; I acknowledge no pope in ſcience: the human mind is free and unconſtrained; it is fit that the ſpirit of enquiry ſhould be free alſo.

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I CONCLUDE the preſent ſection with obſerving that ſince the time of Rivinus, only two leading methods have been offered to the world. Theſe are Tournefort's from the figure of the petals, and the celebrated ſexual ſyſtem of Linnæus from the number, ſituation, union and proportion of the ſtamina. A particular illuſtration of each of theſe methods, with a view of their comparative merits, will make the ſubject of the two following ſections.

SECTION