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Botanick essays : in two parts : with many curious remarks, and several discoveries and improvements. 1720

Blair, Patrick, -1728

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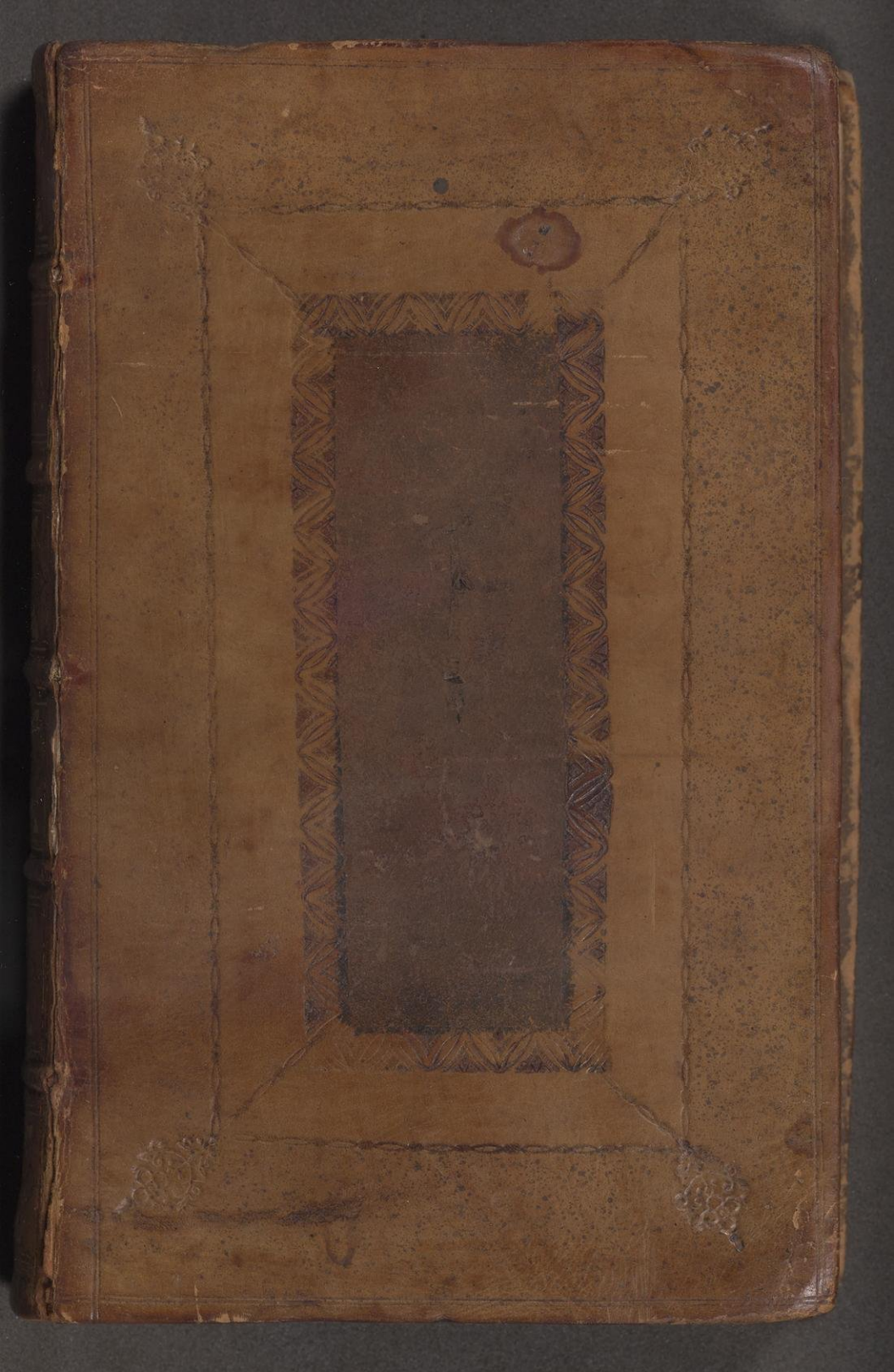

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IMPRIMATUR.

Is. Newton, *P. R. S.*

BOTANICK
ESSAYS.

In Two Parts.

The first containing,

The *Structure* of the *Flowers*, and the *Fructification* of *Plants*, with their various Distributions into *Method:*

And the second,

The *Generation* of *Plants*, with their *Sexes* and Manner of *impregnating* the *Seed:* Also concerning the *Animalcula in Semine Masculino.*

Together with

The *Nourishment* of *Plants*, and *Circulation* of the *Sap* in all Seasons, *analogous* to that of the *Blood* in *Animals.*

WITH

Many Curious Remarks, and several *Discoveries* and *Improvements.*

Adorn'd with Figures.

Non *fingendum* aut *excogitandum*, sed *inveniendum*, quod Natura *faciat* aut *ferat.* Bacon.

By *PATRICK BLAIR*, M. D.
Fellow of the Royal Society.

LONDON:
Printed by *William* and *John Innys*, Printers to the Royal Society, at the *Prince's Arms*, the *West* end of St. *Paul's.* MDCCXX.

TO

Sir ISAAC NEWTON, K^t.

PRESIDENT;

And to the

Council and Fellows

OF THE

ROYAL SOCIETY

FOR THE

Advancement of Natural Knowledge:

ALSO TO

Sir HANS SLOANE, Bar^t.

PRESIDENT;

And to the

Governors and Fellows of the Royal College

of PHYSICIANS, London.

THESE

BOTANICK ESSAYS

Are humbly presented by

Their most humble Servant,

Patrick Blair.

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THE PREFACE.

THE PREFACE.

BEING willing to gratify the Royal-Society, *by entertaining them with ſome Diſcoveries and Improvements in* Botany, *I choſe* the different Sexes of Plants *for my* Theme. *Their favourable Acceptance of my Diſcourſes, and the Entreaty of ſeveral of their Learned and Worthy Members, encourag'd me to enlarge upon that Subject, and to compoſe the following Treatiſe, which is now publiſhed at the Deſire, and by the Command of that* Honourable and Learned Body.

The conſiderable Progreſs of Botany *in* Britain *of late Years, was that which engag'd me the more cheerfully in this Undertaking; for as Dr.* Grew *was the firſt who diſcovered the* two Sexes of Plants, *and Dr.* Moriſon *is own'd by all to be the Reſtorer, if not Founder of the* Method *of diſtributing them* ſecundum Cognationes & Affinitates, *which has been ſince ſo much improv'd by Mr.* Ray; *ſo I reſolv'd not to be wanting in*

making ſome farther Advancements in both, in order to render them more intelligible by the following Eſſays.

I have divided this Treatiſe *into Two Parts, the one containing what is proper to* Plants, *and the other what is common to* Plants *and* Animals. *By the one I propoſe to inſtruct the* Botanick Student, *and the other is deſign'd for the Information of ſuch as are more knowing in that* Science.

As the Flowers *and* Fruit *of Plants, are chiefly to be conſidered for their more convenient Diſtribution into Method, and for the better explaining of* their Sexes, *and manner of* impregnating *the* Seed, *ſo I have thought fit to treat of them in the two firſt* Eſſays. *In the firſt, I have deſcrib'd the Parts for Generation in both Sexes; and the ſecond gives an Account of the ſeveral Kinds of* Fructification. *In theſe I ſhew, wherein lies the difference betwixt* Piſtillum *and* Stylus, Calix *and* Perianthium, Siliqua *and* Capſula.

The Third Eſſay, *which treats of the ſeveral Methods, is both uſeful and neceſſary. For* Method *has of late Years been ſo far multiply'd, the* Plants *ſo variouſly diſpos'd, and the* Authors *of the ſeveral Diſtributions have had ſuch Conteſts and Debates, which ought to be preferr'd; that inſtead of informing, they have often led their Followers into the Errors they themſelves had advanc'd, and encreaſed Faction and Diviſion in a Science*

of

of it self so very innocent, that they have actually broke out into a Paper *and* Botanick War; *by which an excellent* Institution *is perverted, and what was intended for its Welfare, is like to become its Ruine. In order to prevent the Mischiefs of such a growing Evil, I have propos'd the following Means of an Accommodation:* 1. *To treat of the Origine and Progress of Method.* 2. *To acquaint the Reader with the general Rules laid down for the Establishment of each Method.* 3. *To examine every one of them briefly, and to enquire into their several Distributions, that I may shew how far each* Genus *or* particular Species *have been* regularly *or* irregularly dispos'd, *according to their* Characteristick *or* Distinctive Notes: *So that in few Sheets the several Methods have been so compar'd with each other, that the* Botanick *Student may soon be inform'd both of their Failings and Perfections. This has hitherto been much wanted, and has not as yet been attempted by any, except what Mr.* Ray *himself, and* Dillenius *have done, for the better Establishment of Mr.* Ray's Method. *In this I have behav'd so impartially, that I have given a full View of the Advantages, nor have I expos'd the Imperfections of any, beyond what was necessary to clear up the Truth; and I hope it will prove so beneficial, that without turning over the Volumes of the Methods themselves, the inquisitive*

quiſitive Student may come to have ſo juſt an Idea of Method in the general, how ſuch a Plant is plac'd according to the one, and how it ought to be plac'd according to the other, that being diligent he may ſoon arrive at a moſt intimate Knowledge in Botany. *And for his better Aſſiſtance, I have given an Account of what is meant by* Method, *what a* Characteriſtick *and* Diſtinctive Note *is, how many of theſe* Notes *ought to concur to make up the* Character *of a* Plant; *and what is meant by* Claſs, Sect, Genus, Species, &c. *according to the ſeveral Authors. After that I proceed to the Examination of all the* Methods *that have been propos'd, from Dr.* Moriſon *down to this Time; ſuch as Mr.* Ray's, Ammannus, Herman, Rivini, Volkhammer, Tournefort *and* Knaut. Moriſon *deſign'd to Claſs by the* Fruit *and* Seed, *and to diſtinguiſh by the* Flower. Ammannus *and* Herman *are the Improvers of his* Method. *Mr.* Ray Claſſes *by the* Fruit, *and diſtinguiſhes by any other part of the Plant which is moſt fix'd and unchangeable, whether it be by the* Flower, *with its Diſpoſition and Number of the* Petala, *by the Diſpoſition of the* Leaf, *or by the* Root. Rivini Claſſes *by the* Flower, Volkhammer *chiefly by the* Seed; Tournefort *by the* Flower *and* Fruit, *and* Knaut *by the* Flower, *with a little Variation from* Rivini *and* Tournefort. *In a word, this* Eſſay *is not only calculated for ſuch* Methods *as have been eſta-*

bliſh'd

bliſh'd already, but alſo to render whatever Methods *ſhall be propos'd hereafter, more eaſy and intelligible.*

As ſeveral have treated of what is contain'd in the Second Part, viz. *The* Generation *and* Nutrition *of the* Plants, *ſo I have endeavoured to canvaſs their Writings ſo, as to add what I think has been wanting, to correct what by proper Experience I find they have advanced amiſs, and to make ſeveral Diſcoveries and Improvements upon the whole.*

In the Fourth Eſſay, *which treats of the* Generation *of* Plants, *I have proceeded in the following manner:* 1. *I have ſhewn, that ſince* Almighty God *was pleas'd to impoſe a Neceſſity of* two Sexes *upon* Animals, *the ſame Neceſſity appears to be in* Plants *alſo.* 2. *That as no Seed can act within it ſelf, for then it would be* Agens & Patiens actu & potentia in Seipſum, *as* Sennertus *well obſerves, ſo it is neceſſary for it to receive ſome ſubtile Particles from without, to act upon its groſs Subſtance, and to diſpoſe it* Tempore & Loco Opportunis, to chit *and* vegetate. 3. *I have endeavoured to give ſome farther Proofs of this Neceſſity, from ſome negative Experiments.* 4. *This Neceſſity farther appears from the perpetual Preſence of the* Flowers *before the* Fruit, *without which the* Fructification *cannot be perfected.* 5. *I have compar'd the ſeveral Parts of the*

Flowers

Flowers *to those for* Generation *in* Animals, *and shewn, that the* Farina *must contain the Male Seminal Matter*; *because* 1. *Though all the other Parts of a Flower may be, and are actually wanting in some Plants, yet the* Apices *are never wanting.* 2. *The* Apices *are always full before the* Flower *is* blown, *and they are ready to shed the Dust when it is* expanded. 3. *The* Seeds *never begin to swell and augment before the Dust is shed.*

In this, as in the former Essay, *I trace the Origine and Progress of the Opinion, that* Plants *as well as* Animals, *have* Male *and* Female Sexes, *from Dr.* Grew *the Discoverer, down to this present Time*; *and am glad to find that the* ROYAL SOCIETY *has so great a Share in the Discovery and Improvement of what is able to give the clearest Light into the Knowledge of the Manner of* Fecundation *or* Impregnation, *not in* Plants *alone, but in* Animals *also. Dr.* Grew *it was who first gave the Hint to this Opinion. It has been handsomely and succinctly improv'd by Mr.* Ray. Camerarius, *(as himself acknowledges) was stirr'd up to make a farther Progress in it by their Writings. Mr.* Morland, *willing to accommodate the manner of* impregnating *the* Seed *in* Plants *to Mr.* Lewenhock's *Opinion concerning the* Animalcula in Semine Masculino, *communicated his Thoughts upon that Subject to the* ROYAL SOCIETY, *which*

Mr.

Mr. Bradly *afterward confirm'd by going into his Opinion, and by propoſing of ſome other* Flowers *as Evidences to prove his Aſſertions. Mr.* Geoffroy *made uſe of Mr.* Morland's *Arguments, and* Camerarius *his Experiments, when he communicated his Opinion to the* Royal Acamedy at Paris, *which, by what I underſtand, Mr.* Joiſſeux *does not ſeem to be averſe to, though Mr.* Vaillant *chuſes to diſſent from them, and joins Iſſue with Dr.* Grew *and Mr.* Ray. *Beſide theſe, I find* Boccone *and* Dillennius *to be alſo of Dr.* Grew's *Sentiments.*

Having perus'd and narrowly examin'd all theſe, I find their Opinions to be diametrically oppoſite to each other, and thus ſtated. EITHER *the* Farina *falling upon the* Piſtillum, Vaſculum Seminale *or* Semen, *impregnates the Seed by means of certain ſubtile Particles, which penetrate into the* Seed *it ſelf, and there actuate upon the groſs Particles previouſly in the* Seed-Caſe *or* Uterus; OR *it is a* Congeries *of* Seminal Plants, *one of which* MUST *enter the* Vaſculum Seminale, *and there become the* Semen, *as Mr.* Morland *and his Adherents would have it. To know which of theſe ſeem to be moſt probable, I have with great Pains, and diligent Search, examin'd a great many Flowers this laſt Seaſon, ſeveral of which I have ordered to be delineated, and their Figures to be engraven after the Life, and cannot find the leaſt ſign of Probability*

bability for Mr. Morland's *Opinion*; *but every* Flower *I have obſerv'd, ſhews quite the reverſe*; *and if that* Maxime *hold good, which certainly it do's upon all other Occaſions, that* Nature is Uniform in all its Operations, and that there cannot be two different Ways of performing one and the ſame thing, *Mr.* Morland's *Opinion muſt needs fail. And farther, if it were what he contends for, then the* Farina *would always be proportionable to the* Seed *to be* fecundated, *the contrary of which is evident*; *for* Caprifolium, *one of his Examples, and* Jallapa, *have five* Stamina *and* Apices *only to one* Seed; *and* Nicotiana *has no more to above an hundred:* Papaver *has above a quadruple quantity of* Stamina, *to about half the quantity of* Seed. 3. *Though there be a plain and open Paſſage requir'd for the Admiſſion of the* Farina, *if it is the Seminal Plant, yet there is no ſuch thing requiſite for the* Effluvia, *whoſe Prevalency is fully demonſtrable in other Caſes.*

This Analogy betwixt Plants and Animals afforded me a good Opportunity of prying into Mr. Lewenhock's *Opinion concerning the* Animalcula. *In the examining of which I find,* 1. *If the* Farina in Subſtantia *cannot enter the* Embryones, *no more can the* Animalcula *enter the* Ovum Fœmineum. 2. *No Animal can be produc'd without the Concurrence of* two Sexes, *ſo that theſe* Animalcula *can only be produc'd by* Male *and* Female

Female *of their own* Species. 3. *There would not be so certain a Determination of the Number of the* Fœtus *in certain* Animals, *if it depended upon one of them getting accidentally into the* Ovum. 4. *One of these small* Animalcula *could never infer so vast an Alteration upon the whole* Female Body. *And* 5. *The* Fœtus *would not partake so much of the* Temper *and* Passions, *&c. of the* Female, *if it only were produc'd by the* Male. *These Considerations, will, I hope, give a clearer Idea of the Generation of* Animals, *than has hitherto been entertain'd.*

The fifth *and last* Essay, *contains the manner of* Nourishment *of the* Plants. *The want of a due Consideration of this* Analogy, *has hindred those who well understood the* Circulation *of the* Blood *in* Animals, *from applying so valuable a Discovery to the* Sap *in* Vegetables, *by which the several* Phænomena *concerning the Vegetation of Plants, have hitherto seem'd very difficult to be explain'd; and I hope it will not be disagreeable that I inform the World I have now so far discovered the* Circulation *of the* Sap *in* Plants, *as to render every thing concerning their* Nourishment, Growth *and* Encrease, *most plain, obvious and easy to be understood.*

I have trac'd the Knowledge of the Folia Seminalia *previously in the* Seed, *before* Vegetation, *from* Josephus de Aromatariis *the Discoverer. I have set aside the* Philosophical

phical *and* Chymical *Terms, of* Attraction, Suction, Fermentation, Concoction, Digestion, &c. *and plac'd the* Nourishment *upon the simple Footing of the* Configuration *of the* Particles *and* Pores *by which the* assimulating Quality *of the Ancients will be more easily understood. I proceed to shew,* 1. *That* Plants *are fed by the Extremity of the Fibers of the Root, as Animals are by the Mouth.* 2. *That 'tis by a continual* Succession *of* Nutritive Particles, *which enter certain* Tubuli *at the* Root, *that the* Plant *is stretch'd forth and extended; that when they are arriv'd at the Extremity, they cannot all flow out, but most of them must return towards the* Root, *which re-ascending, perform that which is called* Circulation. *This I have prov'd,* 3. *By the different Position of the* Branches *from the* Fibers *of the* Root; *for whereas the one must be the Consequence of the lateral* Ascent *of the* circulating Particles, *so the other must proceed from their lateral* Descent, *because of their Position obliquely downward. I have demonstrated how the* Carnous *and* Parenchymatous Roots *in some Plants, and* Fruit *in others, may have a particular Circulation different from that of the whole* Plant, analogous *to that in several parts of* Animals. *I have compar'd the* Bark, Wood *and* Pith *of a* Tree, *to the* Skin, Bones *and* Marrow *in* Animals, *given an* Idea *of their* Perennial *and* Annual Surface, *and made it appear,*

that they are reciprocally nouriſhed, i. e. *when the* Annual Surface *is nouriſhed and augmented, the Nutritive Particles circulate directly through the* Perennial, *without contributing towards its Augmentation*; *when the* Annual Surface *is decay'd, the* Perennial *is* nouriſh'd; *and when the* Tree *is ſtretch'd forth as to its length, it ceaſes to grow as to its Bigneſs or Groſſneſs. I have likewiſe explain'd the reciprocal Motion of the Sap betwixt the Root and Top, for when the* Vernal *and* Autumnal Shoots *are puſh'd forth in the* Spring *and* Autumn, *the* Fibers *of the* Root *are only* Mouths *for Reception, and Inſtruments for conveying of the Sap upward*; *but when theſe* Shoots *have acquir'd their full Length, the* Fibers *of the* Root *are ſtretch'd forth, and the* Bark *and* Wood *is augmented, as at the Time of the* Winter *and* Summer Solſtices. *I have prov'd this* Circulation, *by the Experiments of the* Grafting, Inoculating, *and* Circumciſion, *and demonſtrated it from the Obſervation of a* ſtript Jeſſamine. *I have aſcrib'd a quite contrary Uſe to the external* Pores *and* Tubuli *of the* Plant, *and ſhewn, that* Malpighi's Tracheæ, *and Dr.* Grew's Air-Veſſels *are for the* efflux *and not* influx *of Particles, and demonſtratively proved an* inſenſible Tranſpiration *in* Plants *as well as* Animals. *And laſtly, I have prov'd, that no Plant can be nouriſh'd but by the* Earth;

for though they may live in the Air, *and by the* Water, *yet none of these can be said to nourish them, and have explain'd some* Phænomena *concerning the* Succulent Plants.

I have confirm'd the whole, by having recourse to the parallel, negative Operations in Animals, *by some curious Remarks, and practical Observations: To which I shall add a few more in this place, as,* 1. *That the* Preparation *of the* Nutritive Particles *depends upon the Configuration of the Pores, appears from the* Viscum, *which being* nourish'd *by the ascent of Particles from the Earth, and variously prepar'd in their Passage throughout the several* Tubuli *of the* Tree, *affords,* (*by the* Chymical Analysis,) *a greater quantity of active Principles than any other* cortical *or* ligneous *Substance in these* cold Climates, *as has been experimented by the* laborious *Endeavours of that* Learned *and* Expert Physician *Dr.* James Douglass, *R. S. S. who procur'd a great Quantity of* Volatile Salt, Spirit, Fœtid *or* Empyreumatick Oil, *and* Phlegm *by one* Process, *and* Essential Oil *by another: Also a good quantity of* fix'd Salt *by* Combustion, *so that we may admire the Sagacity of the Ancients, who being assisted by no such Experiments, were (as it were) by an Instinct, taught to prescribe it in* Cephalick *and* Epileptick Cases, *along with the Parts of* Animals. 2. *The lateral Tendency of this Sap, when interupted in its Ascent,* analogous *to*

that

that of the Blood *at an* Amputation, *is obvious from an* Experiment *of Mr* Fairchild's *(whom I have often mention'd, and to whom I owe all the practical Observations I have advanc'd concerning the Vegetation) He cut the Stalk of a* white Lilly *from the* Root, *and topp'd it when it began to* flower, *and in a short time it push'd forth* Bulbos *from the sides of the Stalk, which when put to the Ground, sent forth* Fibers, *and became* Roots. 3. *He observes, that if a* Tree *is planted in the* Autumn, *it ought not to be topp'd until the Spring following, for the Sap circulates more agreeably, when allow'd to ascend directly to the top of the Autumnal Shoot, than when interrupted by the cutting it off at the Planting.* 4. *Some Years ago he observ'd a* Plant *of an* Hedge-hog-Aloe *all in a Sweat in the* Green-House, *and wet as if it had been dip'd in Water; of which he could not understand the Reason till next Day, that he found the Plant was dead. This abundantly confirms what I have said concerning the* insensible Transpiration, *and the harm that may happen to* Plants *as well as* Animals, *from too* patent, *or too much obstructed Pores, or a* Plethora, *and too great a Distention of the Vessels; in the like Cases his Method of Cure since is a timely Incision,* analogous *to* Blood-letting *in* Animals.

My extending the following Treatise to such a Length, is the Reason why I have di-

verted the Reader so much by a Preface, in which I was resolv'd to inform him previously with what is to be expected; and to shew that I have not trifled over so many Sheets in vain. The frequent Citations have enlarg'd the Bulk of these Essays, *and some may be ready to look upon them as mere Plagiary upon that Account. Though I have made use of the Sentiments of several Authors, yet I have ingenuously confess'd from whence I had my Helps; and though all I have borrowed were remov'd, these Sheets need not fear the Fate of the* Daw in the Fable, *to be unplum'd and laugh'd at; for if what is contain'd in them were contracted within narrower Bounds, there would still remain several Things of moment that are new, wherewith to exercise the Thoughts of the Curious.*

As the ROYAL SOCIETY *have been pleas'd to approve of this Undertaking, so I hope it will not be unacceptable to the* Royal College of Physicians *also; and if other such curious Persons, as are knowing in the* Natural History *and* Botany *shall be pleased with them, I shall obtain what I desire. I was once afraid, that the agreeable Science of* Botany *should be at a Loss by the Death of Mr.* Ray *and several of his Correspondents, but I am glad to find that it still continues in its former Vigour, under the happy Influence of* Sir Hans Sloane, President *of the* College *of* Physicians, *to whom I have been singularly oblig'd. Dr.* Sherard

Sherard *who had the Civility to afford me the use of what Books I wanted to farther my Design*; *Dr.* Tancred Robinson, *and Dr.* Dale, *all of them Mr.* Ray's *good Assistants and Contemporaries, yet alive. To whom may be added Mr.* James Sherard, *well acquainted with the* Indigenous British Plants; *Mr.* Rand, *an* Ingenious *and* Expert Botanist, *Overseer of* Chelsea Garden, *and Mr.* Millar *his Assistant*; *Mr.* Dandrige, *a curious* Botanist, *and Natural Historian, and famous for his Collection of the* Eggs *of most of the* Indegenous Birds *in* Britain; The Honourable Lord *Colvil*, an expert Botanist (and knowing in most of the liberal Sciences) in *Scotland*; *And Mr.* George Prestone, *an* Indefatigable Botanist, *and* Intendant *of the* Physick Garden *of* Edingburgh, *with several others in this Island. And if, after the constant and assiduous Observation of the Plants themselves, I have been enabled* raptim, *and as it were in a Hurry, to expose these* Essays, *as the Effect of the Discoveries and Improvements of one Season, I hope the* Candid Reader *will excuse what Irregularities and Incoherencies I have been guilty of, since 'twas the Matter, not the Manner of prosecuting my Design, I was most intent upon, that he'll accept of what is here advanced as an earnest of my Desire of Improvement, and pass by my Infirmities*; *for* Humanum est errare, *Weakness is sometimes bewray'd in the best of Performances.*

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ther

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BOTA-

TAB. I.

Fig. 1.

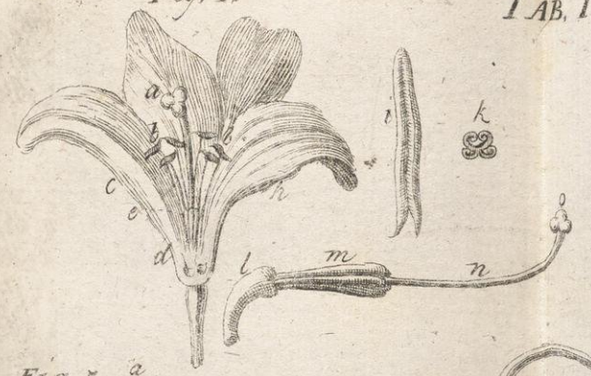


Fig. 2.



Fig. 3.



Fig. 4.



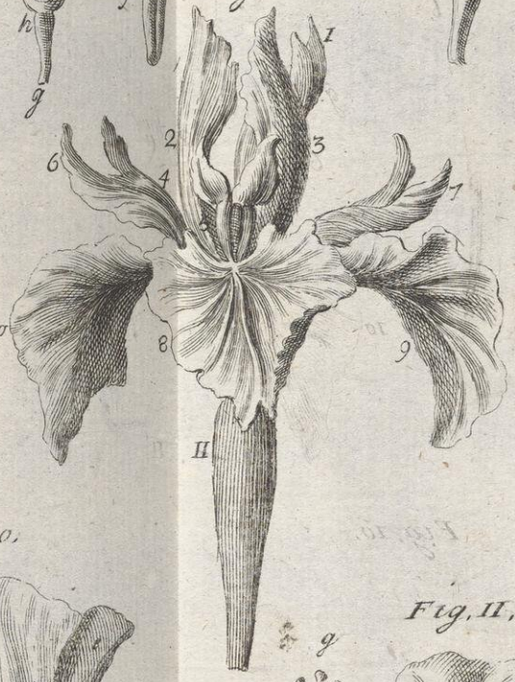
Fig. 5.



Fig. 6.



Fig. 7.



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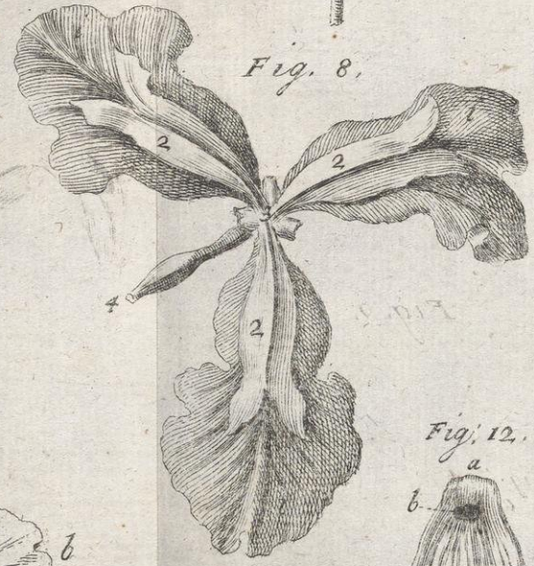


Fig. 13.



Fig. 9.



Fig. 10.



Fig. 14.



Fig. 11.

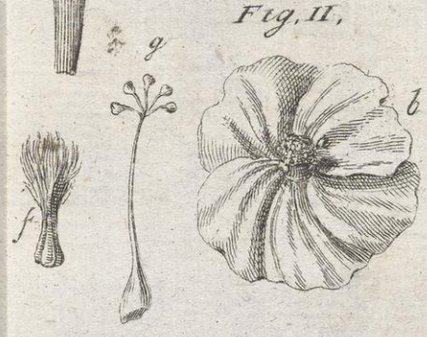
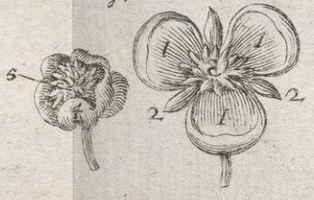


Fig. 12.



Fig. 15.



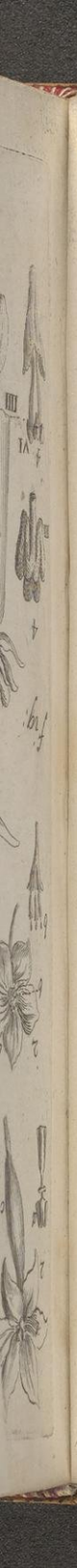



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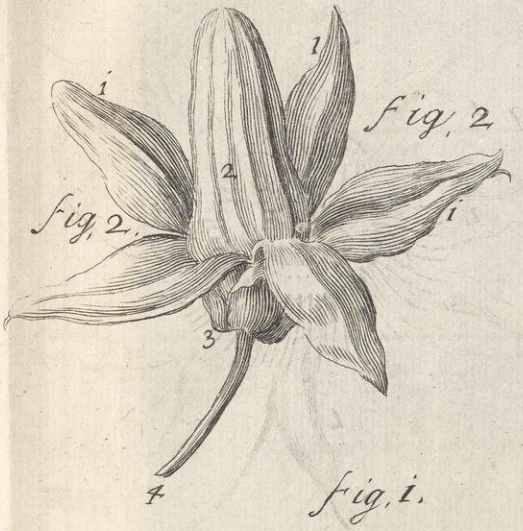
fig 4



fig, 2.



fig, 1.







fig, 3.





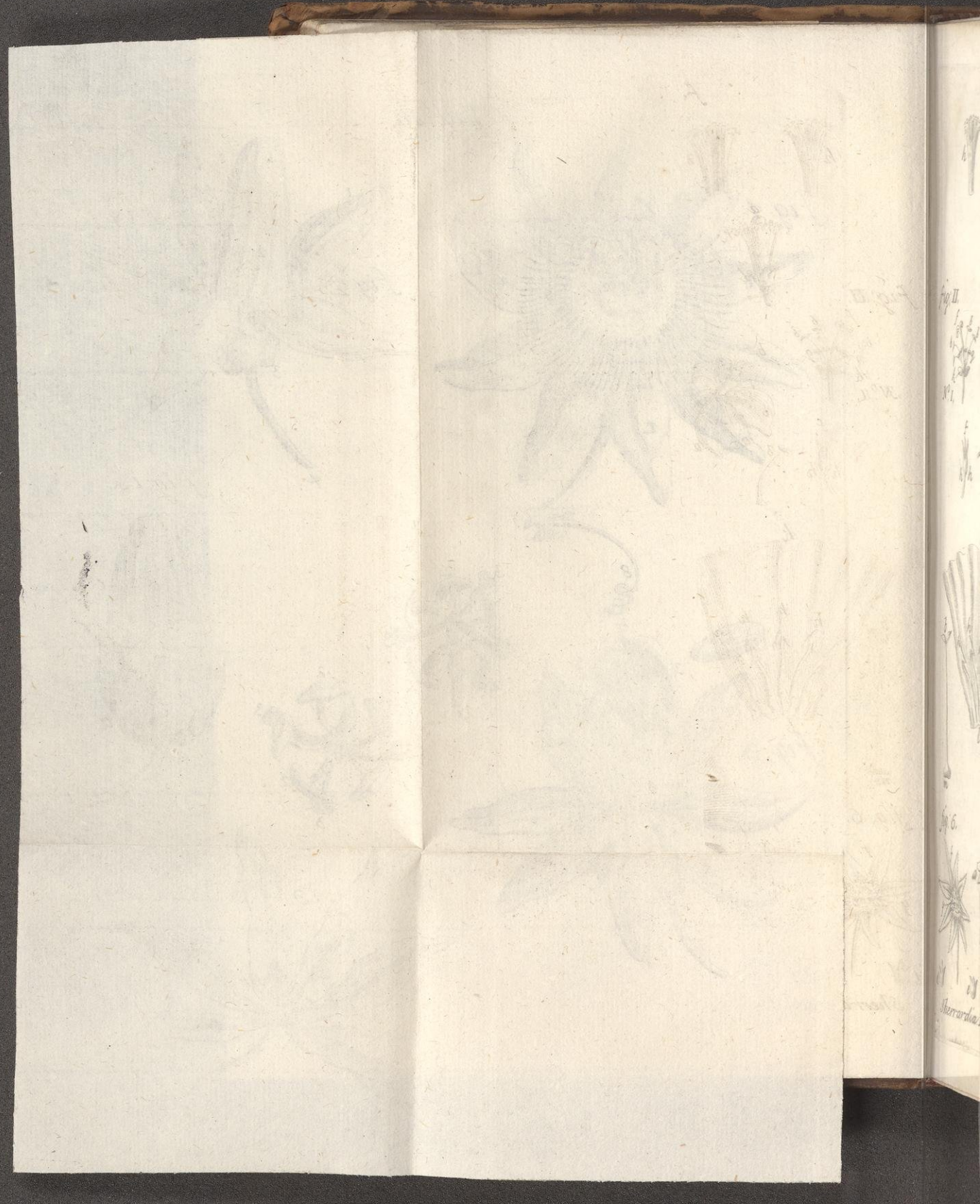


fig. 4.





fig. II.







fig. I.





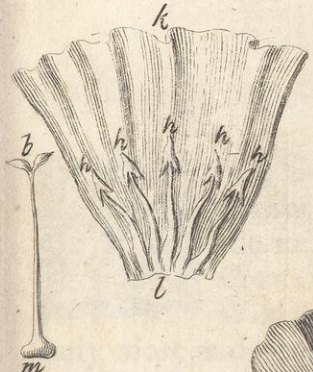


fig. 3.





fig. 6.



fig. 7.



Sherrardia Dillenij.

BOTANICK
ESSAYS.

Essay I.

Upon the Structure of the Flowers.

As the Generation of *Animals* has ever been look'd upon to be one of the moſt myſterious Parts of the Creation, in which the infinite Wiſdom of the *Great Creator* is daily more and more manifeſted, ſo the *Vegetables* have ſufficient Curioſities in them wherewith to exerciſe thoſe rational and ſupereminent Faculties with which the Soul of Man is endow'd. *Animals* are ſuch curious Pieces of Mechaniſm that the Ingenious have from all Ages conſider'd them as fit Objects of dili-

gent Enquiry: but for the *Vegetables*, their Parts ſeem at firſt view to be ſo ſimple, that the prying into their Structure has been much neglected. Ancient and learned *Botaniſts* contented themſelves with viewing the *facies externa* of Plants, in order to diſtinguiſh them from each other; and if they had the good Fortune to impoſe ſuch Names upon them as are retain'd to this Day, yet they were generally ſo ſuperficial in deſcribing them by theſe Names, that the modern Writers in *Botany* have great difficulty to know which is which. The word *Eupatorium* was frequently us'd in former Times; now we find three Plants, vaſtly different from each other, under the ſame Name. *Eupatorium Veterum* is now underſtood for *Agrimonia*; *Eupatorium Avicennæ* is that which paſſes under the Name of *Eupatorium Cannabinum*; *Eupatorium Meſues* is the *Ageratum*. *Dioſcorides* ſays, that the Herb *Hyſſopus* is known to every one; and the learned Dr. *Tournefort* obſerves[a], "That the *Hyſſopus* of *Dioſcori-*
"*des* is an Herb, which is ſcarce known to a-
"ny, though he performs Miracles by it;
"for having compar'd *Origanum* with *Hyſ-*
"*ſopus*, *Centaurium Minus*, *Tragoriganum*,
"*Serpillum Marum*, *Polycnemon*, *Symphy-*
"*tum Petreum*, *Ageratum*, *Papaver er-*
"*raticum*, are all, according to him, like
"unto *Origanum*." The Ancients have cer-

[a] Tourn. Iſagog. in Rem Herb. p. 14.

tainly

tainly had another *Centaurium* and *Chelidonium Majus*, for they could never be so ignorant as to believe *Centaurium* and *Chelidonium Minus* were of the same *Genus* with them.

As Arts and Sciences came to be more and more cultivated, so the delightful Science of *Botany* still arriv'd at a greater Degree of Perfection. They first began to distinguish the Plants according to the Nature and Texture of their Parts: Thus they which were of a harder, more durable and solid Substance, these were call'd *Arbores* Trees, and their Substances called *Lignum* Wood or Timber; such as are of a woody Substance, but not so high a Stature nor of so long Duration, these are called *Frutices* Shrubs: A third Division is called *Suffrutices* Under-Shrubs, which are woody indeed, but are of a very low Stature and short Duration, such as *Lavendula*, *Hyssopus*, *Thymus*, *&c.* And lastly, they are called *Herbæ* Herbs: these are of a very soft Texture, and only endure but for one Season, or at most till they have perfected Fructification, and produced ripe *Seed* for the Propagation of the *Species*, and then they decay. These, according to their Duration, are either propagated by the Seed, which, according as it ripens the first, second or third Year, if the Root decay immediately thereafter, is said to be an Annual, Biennial or Triennial Plant; or by the Root, which does not decay, but

puſhes out a freſh Herb every new Seaſon, and then it is called a Perennial Plant.

In former Times when Authors were about to give a Hiſtory or Deſcription of Plants, they had ſeveral very confus'd ways of ranking them: ſome according to the *Alphabet*, by which it could not be known which belong'd to one *Genus* and which to another: ſome according to their *Virtues*; but as there are many Plants whoſe Virtues are not rightly underſtood, and as there are ſeveral Plants of different *Genera* which partake of the ſame Virtues, the Diſtribution of the Plants after that manner is very uncertain: and ſome according to the different Seaſons or Months in which they produce the Flower; but as there are ſeveral Plants of the ſame *Genus* which flower more early, or in the Spring, and others more late, or in the Autumn, as *Crocus Vernalis* and *Crocus Autumnalis*, *Gentianella Vernalis* and *Gentianella Autumnalis*, this way of claſſing the Plants can be uſeful to none but Floriſts, who are oblig'd to obſerve the Seaſon of Flowering on purpoſe to adorn their Gardens at all Seaſons of the Year.

At laſt, obſerving what an Harmony there was among the ſeveral Parts of the Plants; how ſeveral of them agreed together in the ſame Frame and Diſpoſition of the *Leaf*, but perhaps differ'd in the *Flower* and *Fruit*; others agreed in *Flower* but differ'd in the *Fruit*; others agreed in *Flower* and *Fruit*

but differ'd in the *Root*, as *Iris Tuberosa* and *Bulbosa*, Authors bethought themselves of classing the Plants, according to the Similitude of a particular Part of one Plant with that of another; as by the Root there are the *Radices Bulbosæ*, *Tuberosæ*, *&c.* by the Leaf *Asperifolæ*, *&c.* by the Flower according to their *Petala*, *Monopetali*, *Polypetali*, *&c.* Disposition of the *Flower Umbelliferæ*, *Corymbiferæ*, *&c.* according to the *Fruit Seminibus Nudis Solitariis*, or *Aggregatis*, *Capsulis inclusis*, as *Unicapsulares*, *&c.*

After that there arose a Debate among Authors, which were the principal Parts of the Plants by which they may be the most conveniently class'd together: some were for admitting of one part as only essential, others for two or three together, and a third sort were for bringing in all these as essential Parts, which kept a certain Rule, and were always the same in every *Genus*, or each individual Species: *v. g.* If one kind of Plants had always a *Bulbous Root*, another *Leaves* alternately upon the Stalk, a third *Genus* had the *Leaves* arising by Pairs, some *Genera* had an *undivided Leaf*, and in others they were *divided* into several *Segments*, they did not doubt but *Plants* might be join'd together by these *Notes*, as well as by any other.

The first we find who condescended upon any particular Part or Parts of the Plant, as being most essential, and by which they ought

to be more especially ranked together, was that celebrated Natural Historian, *Conradus Gesnerus*. He writing to *Boccone*, tells him, that he was very exact in delineating the *Seeds* and *Flowers*; "for (says he) it's from "the *Seed* I usually determine the Affinity of "*Plants* [b]". And again, in his *Epistle* to *Theodorus Zuingerus*, he writes, "'Tis from "these (says he) *viz.* from the *Flower* and "*Fruit* of *Plants*, rather than from the "*Leaves*, that the Nature and Affinity of "the *Plants* appear: for it's by these Notes, "(to wit the *Fruit*, *Flower* and *Seed*) that "*Staphisagria* and the *Plant* called *Consolida Regalis* are distinguished from *Aconitum*, though they agree in the *Leaf* [c]:" And in his Epistle to *Adolphus Occon* he plainly declares his Mind, "[d] *Melissa Constantinopolitana* seems in some measure to resemble *Lamium* or *Urtica Mortua*, but it dif-

[b] In seminibus & floribus ἀκριβέστατα pingendis valde sum curiosus & à semine maximè cognationes stirpium judicare soleo. Epist. Medicin. lib. 3. Epistola 13. 14. ad Boccenem.

[c] Fundamenta hîc maximè ponebat Gesnerus in flore & fructu plantarum. Ex his enim potius quàm foliis stirpium natura & cognationes apparent. His notis à fructu semine & flore Staphisagriam & Consolidam Regalem vulgò dictam Aconito συμφύλους εἶναι βοτάνας facile deprehendi. Epist. p. 113. ad Theodorum Zuingerum.

[d] Melissa Constantinopolitana ad Lamium vel Urticam Mortuam quodammodo videtur accedere; seminis tamen, unde ego cognationes stirpium indicare soleo, figura differt. Epist. p. 65.

"fers

" fers from it by the Figure of the *Seed*, by " which I uſe to judge of the *Affinity* of " *Plants* [e]."

Fabius Columna is the next who declares his Mind, concerning the Manner of diſtributing the Plants by the *Flower* and *Fruit*. " I do not value (ſays he) the Shape of the " *Leaf* in making up the *Genera* of *Plants*, " but I determine their Kindred and Family " to which they belong, by the *Flower* and " *Seed Veſſels*, or rather the *Seed* it ſelf, " eſpecially if they agree by the Taſte with " the other Parts of the Plant. This is what " has not been obſerv'd by *Botaniſts* before " this time, neither by *Dioſcorides* himſelf, " nor yet by the Ancients [f]."

Cæſalpinus is the third who gave any conſiderable light into that of diſtributing the Plants by Method, as is related by *Tournefort* [g]. " This Part of *Botany* (ſays he) not " yet eſſay'd by any, was manag'd by *Cæſal-* " *pinus* with a great deal of Induſtry; who " was the only one among the *Botaniſts* who " gave the Reaſons worthy of a Philoſopher,

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[e] Tournef. Iſagog. in Rem Herb.

[f] Foliorum effigiem in conferendis generibus parvi facimus; non enim ex foliis ſed ex flore ſeminiſque conceptaculo aut potius ipſo ſemine plantarum affinitatem dijudicamus (reſpondente partim ſapore in reliquâ parte plantæ) quod huc uſque ab Herbariis nondum animadverſum nec ab ipſo Dioſcoride nec ab antiquioribus. Ecphraſ. minus cognitarum ſtirpium pars altera. c. 27. p. 62 & 63.

[g] Ibid. p. 66.

" for distributing the Plants into a Method, " according to the Manner of their Seed." But he is so obscure in laying down his Method, that neither *Tabernomontanus* nor the two *Bauhini* would make use of this Method of *Columna* and *Cæsalpinus*; nor would any other attempt it before Dr. *Morison*, as is justly observ'd by *Knautius*[h]; and *Gaspar Bauhinus* gives the following Reason for it. " *Cæ-* " *salpinus*'s Method of Plants (says he) was " much in my mind: I spent much time in " reading, that I might class my Plants by it. " He is a learned but most obscure Author. " I had great difficulty to understand it. I " know not how he can be understood by " Disciples and Students[i]."

From all these it plainly appears, how long it was before *Botanick* Authors so much as dream'd of disposing Plants into a Method, and how obscurely these Hints were given, by those who first determin'd by which part of the Plant they should be class'd; so that it is evident, the true Method of distributing and classing them was never throughly understood until Dr. *Morison* both began and brought it to great perfection; whatever can be alledg'd

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[h] Method. Plant. Genuina. p. 4.

[i] Cæsalpini de plantis liber multùm mihi obfuit, in quo legendo diu hæsi, ut in meas classes referrem: doctus est sed obscurissimus; multas mihi parit molestias in eo intelligendo; nescio an à Tironibus & studiosis intelligatur. Epist. ad Sigismund. S. Schriterium.

or affirm'd to the contrary: But how he began it, after what manner he profecuted it, and what improvement the *methodifing* of Plants has fince receiv'd fhall be declar'd hereafter. But as the *Flowers*, *Fruit*, *Seed Veffels* and *Seeds*, are the principal Parts of *Plants*, as 'tis chiefly by them that *Plants* have been diftributed of latter Years; and as the Structure and Ufe of their feveral Parts, efpecially of the *Flowers*, have hitherto been much neglected, I fhall firft explain them feparately, and then declare the Ufe which is made of them, in order to find out their true *Genera* and *Species*, and what their Ufe is in impregnating of the Seed, in order to the Generation and Propagation of the feveral Species.

A *Plant* is an *organical Body*, endow'd with a *vegetative* not *fenfitive Life*, adhering to one particular Place from whence it receives its Nourifhment; having always a *Root*, for the moft part bearing *Seed*, and frequently endow'd with *Leaves*, *Stalks* and *Flowers*.

It might have been aflerted in the Definition, that *Plants* have always *Seeds* as well as *Roots*; for we cannot fuppofe any *Plant* to have been firft propagated but by the *Seed*; but fince there are fome Species which are generally barren, that is to fay, which are feldom or never obferv'd either to bear *Flower* or *Seed*, therefore it's faid, that *Plants* for the moft part have *Seed*, *v. g.* There is in moft Gardens

Gardens in *Scotland* the *Chamæmelum Sterile*, and here in *England* as well as in *Scotland* the *Acetosa Muscovitica Sterilis*, both which are seldom or never observ'd either to bear *Flowers* or produce *Seed*, the Manner of propagating them being by the Root. The *Hedera Arborea* is said to have one Species, which is barren, but I'm ready to believe that's a Mistake; for it has been observ'd, that when it's planted in a convenient Soil, in a suitable Season, it will change the Figure and Fashion of the *Leaf*, from being blewish, broad, and more angular, to become more narrow, dark, green and pointed, after which it pushes forth the *Flower* and bears the *Fruit*. *Epimedium* and *Hydrocotyle* of *Tournefort*, or *Cotylidon-aquat.* were through inadvertency look'd upon as barren formerly, because their *Flower* is never seen unless you turn up the *Leaf*; and therefore the *Epimedium* is still known by the Name of *Barrenwort*.

Vinca pervinca, or *Clematis daphnoides*, flowers plentifully every Year, but never produces the *Pod* or *Seed Vessels* in its native Soil, especially in these colder Climates; because most of its Nourishment is spent in sending forth abundance of new Twigs and Leaves, by which it overspreads the whole Ground; but if it be put into a Pot, and all its *Stolones* or *Shoots* be taken off, but one or two of the strongest, then it will produce the *Pod* or *Seed Vessel*, which shall contain *Seed* till it ripen,

ripen, according to the Obſervation of Dr. *Moriſon* and Dr. *Tournefort.*

Acorus Verus S. Calamus Aromaticus being planted in a Garden will ſeldom or never bear a Flower or Spike, and but rarely in its native (*i. e.* a Marſh or wateriſh) Soil, becauſe its Nouriſhment is as much exhauſted upon its running Root below, as it is in the former upon the Leaves and Stalks above Ground.

A *Plant* is ſaid to adhere to one particular Place from whence it received its Nouriſhment, becauſe all *Plants* are not nouriſh'd by by the *Earth*; for thoſe called *Paraſitical Plants* are nouriſh'd by any other Subſtance than the *Earth.* The *Cuſcuta*, though it ſprung from the *Seed* which falls to the Ground, yet no ſooner does it catch hold of any other *Plant*, as *Thymus*, (upon which account it is called *Epithymum*) or upon the *Linum Sativum*, (when it ſtill retains the Name of *Cuſcuta*) it immediately quits the Earth, and by ſending forth ſeveral ſmall Nails (as it were) which are drove into the very Subſtance of the Plant, it receives the nutritious Particles, which are converted into its proper Subſtance. *Hedera Arborea* will indeed receive its Nouriſhment from the Earth, when it has nothing elſe to lay hold on or graſp, but as ſoon as it touches any live or or growing Tree, or any Wall, whether of Stone or Brick, it fixes its Tendrils into the

Bark

Bark or Subſtance of the Tree, or into the Interſtices betwixt the Stones and Brick in the Wall, from whence it receives its Nouriſhment, and quits, or partakes but little of the Earth: But the *Viſcum* denies any Commerce or Correſpondence with the Earth at all; for if the Berry fall to the Ground there the *Seed* periſhes; but if plac'd upon any Tree it there takes root, and encreaſes by diſperſing the Fibres of its Root throughout the whole Subſtance of the moſt ſolid Tree, ſuch as Oak, and a great many other Trees, as other Plants do in the Earth.

Plants may be *Acaules* or want a *Stalk*, as the *Lichenes*, *Aphylli*, or *Nudi*, wanting *Leaves* as the *Junci* and *Scirpi*. They may want the *Flower*, at leaſt obvious to the naked Eye, as the *Capillares*; though by the Help of Magnifying Glaſſes, they are obſerv'd to have a regular Flower as well as other Plants, which are either plac'd upon the back of the Leaf, and therefore they are called *Epiphylloſpermæ*, becauſe both *Flower* and *Seed Veſſel* were formerly taken for the *Seed*, as in the *Polypod* and other *Ferns*, or upon the top of the Stalk, for which they are called *Florids*, as the *Oſmunda Regalis*, and *Filicula Montana*, *Florida Perelegans*; but no Plant can be without Seed, unleſs there be ſome other Means by which the Plant is propagated.

Therefore

Therefore I cannot comply with *Dillenius*'s Sentiment, who defines a *Fungus* or Mushroom, to be a kind of "barren Plant without Flower or Seed, produc'd by a putrid "or rotten Ferment; (upon which account, "says he, it is, that they generally spring in "a moist and rainy Season, and are, for the "most part, of a soft and spongy Substance) but "the Species is preserv'd by a certain specific "and corruptible Juice, from whence it ari-"ses; so that by this putredinous Motion "the Texture and Principles of the Vegeta-"bles are much altered, and almost de-"stroy'd [k]." I must confess this is a new Philosophy to me, but most improbable; for as it can be made appear by frequent Experiments, that Insects are not produc'd *à putredine*, which was the Opinion of the Ancients, *sed ab ovo*, so we have the same Reason to believe, that no kind of Plant can be generated *à putredine sed à semine*; and it's but a bad Argument, because their *Seeds* have not yet been discovered by *Microscopes*, therefore they are not; but the *Seeds* of these, formerly reckon'd *imperfect Plants*, have now been fully discovered, as fully appears from the *Memoirs of the Royal Academy at Paris*, for the Years 1711, 1712. concerning the Vegetation of the *Tubera Trees* or *Trufles*, and concerning the *Fuci Marini*.

[k] Dillen. de Plant. Circa Giffam nascent. Nova Plant. Spec. Clas. de Fung. p. 27. Edit. 1719.

Leaving

Leaving the Consideration of such Parts of the Plants as are of less moment for my Design, I now proceed to the more particular Description of the *Flowers*, and the several Parts of which they are compos'd.

A *Flower* then is the most tender and delicate Part of the *Plant*, remarkable either for its peculiar *Colour* or *Figure*, or for both; coherent with the *Rudiments* of the *Fruit*, to whose tender Parts it seems to give the first Supply of Nourishment.

I am not much of *Tournefort*'s Opinion, that the *Flower* affords any Supply of Nourishment to the *Fruit*; (though by his Example I have made it a part of the Definition:) One part of its Use indeed may be to guard the tender *Fruit*; but for the Nourishment, both the *Fruit* and it are oblig'd to the proper *Pedicle* or *Foot-Stalk*, if there be any, or to the common *Stalk* from whence it arises, if there is no *Pedicle*, which is a liberal Mother, and nurses both equally as their several Exigencies require.

Flowers in general are compos'd of the *Petala* or *Flower Leaves*, the *Calix* or *Cup*, the *Perianthium* or *Cover-flower*, the *Pistillum* or *Pestil*, the *Stylus* or *Stillet*, the *Apices* or *Tops*, the *Stamina* or *Chives*, the *Capillamenta*, *Threads* or *Thrumbs*: or if you please they may be divided with the *learned* Dr. *Grew* into three constituent Parts, *viz.* the *Empalement* or *Calix* and *Perianthium*; the

the *Foliature* or *Petala*, and the *Attire* or inner Furniture of the *Flower*, ſuch as the *Stamina*, *Apices*, *Piſtillum*, *Stylus*, *&c.* or they again may be divided into their outer and inner Part; the outer Part conſiſting of the *Petala* and *Calix*, or *Perianthium*; and the inner, which is the ſame with Dr. *Grew*'s *Attire*.

The *Petala*, according to Dr. *Tournefort*, are thoſe *Leaves* which excel all the other *Leaves* of the *Plant* in *Shape* and *Colour*, and which never become the *proper Seed Veſſel*; they are that thin and delicate Subſtance which ſurround the other Parts of the *Flower*, whoſe ſhining Beauty, and vaſt variety of Colours attract the *Eyes*, and create a great deal of Pleaſure and Delight, affording a moſt agreeable Spectacle to Beholders both in *Gardens* and *Fields*, which engage a great many to a particular Conſideration of their *Number*, different *Colours*, and variety of *Stripes*; and which, together with the Manner of propagating and improving the *Flowers* abounding with ſuch, is become a particular Science, diſtinguiſh'd by the Name of *Floriſt*. In a word, they are an Ornament to the *Flower*, as the *Leaf* is to the *Stalk* and *Branches* of the *Plant*, with this Difference, that the other *Leaves* are always green, but theſe are ſtill diſtinguiſh'd by their Colour. *Fabius Columna* was the firſt who, according to *Tournefort*, made uſe of the word *Petalon*

to distinguish the *Flower Leaves* from the other *Leaves* of the *Plant*.; since which it has always been assum'd as a *Term of Art*; and I rather chuse to call it *Petal* in *English*, than to express it by that compound Word of *Flower Leaf*. They are sometimes of a green Colour, so near to that of the other Parts of the *Plant*, that they are scarcely to be distinguish'd from the Leaves of the *Perianthium*, (whereof hereafter) unless with *Tournefort* it be observed, that they never become the *Capsula* or *Seed Vessel*; and therefore the *Flowers* of both the *Hellebores* may be said to be *Petalous*, though most of them (except the *Helleborus Niger Flore Roseo*, and that called *Aconitum Hyemale*, which is also an *Hellebore*) are of a greenish Colour, and more durable than *Petala* usually are, because they never become the *Seed Vessel* or *Capsula* to the *Fruit*; upon which account they may be distinguished into *Petala Caduca*, *i. e.* those which fall off as soon as the *Fruit* begins to set or frame, or *Seed Vessels* be so strong as to resist the Injuries of the Air; though I do not look upon that as their only Use, as some others do; and *Petala non caduca sed marcescentia*, when they do do not fall off as they decay, but waste upon the top of the *Fruit*, as in the *Campanulæ*, and most of the *Leguminous Plants*.

The curious Dr. *Grew* has some pretty Observations upon these *Petala*, which he calls the

the *Foliature*. " 1. In regard of their *Texture*, " they are either fat and firm, ſtanding upon " a broad and ſtrong Baſe, and ſo need no " *Empalement* or *Calix*, as *Lilies*, *Tulips*, " *Columbines*, *&c.* or delicate, tender and " fine, ariſing long, ſmall and ſlender from " the bottom, and ſurrounded by the *Peri-* " *anthium* or *Husk*, as in *Julyflowers*, and " all that kind of *Flowers* called *Flores Ca-* " *ryophyllæi*, ſuch as *Lychnis*, *&c.* to which " the *Long Tubulous Empalement* ſeems to " be neceſſary; for without it, all of them " would break forth out of their Compaſs. " 2. In reſpect of their ſeveral *Foldings*; and " that either in the *Cloſe Couch*, as in *Roſes*; " *Concave Couch*, as in *Blattaria Fl. Albo*, " *&c.* next the *Plait*, as in ſome of the *Pea* " *Blooms*; next the *Couch* and *Plait* toge- " ther, as in *Marygolds*, *Daiſies*; the *Rowl*, " as in the Flowers of *Ladies Bowers*; next " the *Spire*, which is the beginning of the " *Rowl*, as in *Malva*; the *Plait* and *Spire* " together, as in *Convolvulus Doronici Fol.* " In ſome Flowers, where the *Attire* is lofty " or ſpreading, as in the *Malva Roſea.* The " *Leaves*, with the *Spiral Fold*, are all tack'd " down at the top, thereby making up a blun- " ter *Cone*, and ſo a more ample Space for " the encloſed *Tube* and *Stamina:* In the " *Poppy*, where the Leaves are few but very " broad, and where a ſmall *Attire* is enclos'd, " they could not be reduc'd to any regular

" Fold, leaſt the Air ſhould fill up the *Vacuum*,
" and be prejudicial to the Seed; therefore
" they are cram'd up within the *Perianthium*
" by hundreds of Wrinkles or Puckers, as a
" *Cambrick Handkerchief* is, wrapp'd up and
" thruſt into ones Pocket, *&c.* *

The *Calix* is the next outward part of the *Flower*. This *Tournefort* defines to be the back part of the *Flower*, diſtinguiſh'd from the *Pedicle* or Foot Stalk, by a certain kind of Groſſneſs. By this Definition, the *Calix* and *Perianthium* muſt plainly differ from each other, though our Author makes no ſuch uſe of it, and though moſt of the modern Writers uſe the one or the other without Diſtinction. But in my Opinion, that part of the *Pedicle* which is enlarg'd, and upon which the *Foliature* and *Attire* (as Dr. *Grew* expreſſes it) are plac'd, is the *Calix* of the *Roſe*; and thoſe five Leaves which ſurrounded the Bud before it was blown, may be properly called the *Perianthium*, from the *Greek* περὶ ἄνθος; and I think Dr. *Grew*'s word, *Empalement*, would import the ſame: Indeed the word *Calix*, as it ſignifies a Cup or Veſſel, which contains any Liquor, may imply that part which ſupports the Flower, and upon which it is plac'd, and that part which involves, ſurrounds and guards it: but as *Calix* is become a Term of

* Grew's Anatomy *of Plants*, *Book* I. *Chap.* 5. *pag.* 36. *and Book* 4. *Chap.* 2. *pag.* 164.

Art,

Art, as there is a palpable Difference betwixt it and the *Perianthium* in ſeveral Plants, as is obſerv'd in the *Roſe*, where ever ſuch Difference appears, I would call each by their proper Names; or at leaſt I would ſo uſe the one, as not to neglect the other: Thus the *Calix* is the *Pedicle*, or Foot Stalk enlarg'd, to grant Space to the *Rudimentum Fructûs*, which afterwards becomes the *Hip* in the *Roſe* fill'd with thoſe hard Seeds, commonly called the *Acini* or Stones; but the *Perianthium* is a Production of this *Calix*, or ſo many, *viz.* five Leaves ariſing from it, of a different Subſtance, the one being at firſt thick and pulpous, the other thin and membranous, broad at the Baſe, and narrower as the Bud tapers, and becomes *pyramidal* towards the top, ſtraitly encloſing, and earneſtly preſerving the enclos'd tender *Petala*, until they have acquir'd a ſuitable Bigneſs, and ſuch a durable Conſiſtence, as to render them capable to reſiſt the Injuries of the Air when blown; and theſe five Leaves of the *Perianthium* pleaſantly depart from each other, and readily give way to the *Petala*, whoſe *Moles* is augmented by degrees, and ſtrictly guarding and ſtrengthening them at their *Ungues* or *Origine*, leaſt by the Weight of the inner *Petala*, (eſpecially in the full or Hundred leav'd Roſes, as they are call'd) they ſhould be too much depreſs'd, or violently diſtorted, and turn'd out of their natural Situation: Therefore it is, that

the *Calix* is seldom or never without a *Perianthium*, or a Division into so many green Leaves, (for 'tis by the Colour that they are distinguish'd from the *Petala* in most Flowers) which involve the *Petala* before Expansion, and guard and surround them after they are blown. Their Number is uncertain; sometimes where the *Petala* are few, the Leaves of the *Perianthium* are so too; they are either of the same Number, or just half so many, whether even or odd. *Leucanthimum* and *Alsine*, are *Pentapetalous*, the former has five Leaves, and the latter ten, for the *Perianthium*. The *Pæonia*, while in the Bud, is covered with five Lives, arising streightways from the *Pedicle* it self, and are no ways Productions of the *Calix*, whereof the three inner are more thin and expanded Leaves, which over-spread the whole Bud; and the two outer ones are stronger, more round, situated at the Base of the Flower, to strengthen the other three, that they may be the more able to support the Weight of the Bud before, and Flower after *Expansion*, or after it is blown. In the *Calendula*, and *Bellis*, and most of the *Corymbiferæ Radiatæ*, there are a great many Leaves of the *Calix* which are divided from each other, making up a double or treble Border of a *Perianthium*, to support the *Petala* after Expansion, and keep them in their due Order. The *Calix* of such and the like Flowers, are either of one continued Piece, and divided

divided into the Leaves of the *Perianthium* at the Border, or they are compos'd of several minute, thin Leaves, so dispos'd as the Scales of a Fish, and therefore are called *Calices Squamosi*, as in the *Capitatæ*, such as *Jacea*, most of the *Corymbiferæ Nudæ* and *Radiatæ*; and it is to be observ'd, that in the *Corymbiferæ Nudæ*; that is to say, when they want a Row of half Flourishes round the Border, then there is scarce any *Perianthium*; for there being no long *Petala*, or half Flourishes to support, there is no need of such.

According to this Distinction, it seems improper to call those two *Leaves* which guard the *Flower* of the *Papaver*, *Chelidonium maj. Glaucium*, or *Papaver Corniculatum*, till they are blown, and then do fall off, their *Calix*, and not their *Perianthium*; though Mr. *Ray* is pleas'd to call it *Calix Bifolius*, *Fugax Borrago*, *Chelidonium minus*, *Hepatica Nobilis*. *Tormentilla*, have rather a *Perianthium* than a *Calix*, because the five Leaves of the one, the three of the other two, and the four in the fourth, are divided to the *Pedicle*, which cannot answer the Definition of the *Calix*; neither do I think all the *Pentaphylla* and *Pentaphylloides*, which have alternative broad and narrow Leaves; the *Althea* and *Malva*, which have a double Row of them; nor the *Alcæa*, which has but one *Row*, can be said to have a *Calix* but *Perianthium*. In the *Malvaceous* Kind, these

Leaves are as ready to guard the *Fruit* as the *Flower*, some more firm, and closely surrounding it, as the *Althea* and *Malva Rosea*; others not covering the whole Fruit, as the *Malva Vulg.* and *Arborea Maritima*; and others more loosly covering it, as it were a Bladder, as the *Alcæa*; I say, in that case, these *Leaves* may be called *Pericarpium*.

In a word, There may be a *Perianthium* without a *Calix*, according to the foregoing Examples; as also in the *Male*, formerly called *Barren Flowers* of the *Pomiferæ Scandentes*; according to this Rule, that when the *Leaves* are divided to the *Pedicle*, and that the *Pedicle* at the bottom of the *Flower* is no more enlarg'd, and has not become grosser than there elsewhere, then it is properly *Perianthium:* But very rarely, unless in the former Example of the *Flores Nudi*, shall you see a *Calix* without a *Perianthium*. I own there are some Flowers which have a *Tubulous Calix*, as the *Labiatæ* or *Galeatæ*, and *Verticillatæ*, which afterwards becomes the *Pericarpium*, (as is observ'd in the *Malva's)* and guards the four Seeds till they are ripe; though Dr. *Tournefort* calls them *Capsula's*, which I think is wrong; for as I take it, *Capsula* is a *Receptaculum Seminis* or *Close Vessel*, which preserves the *Seed*, and never is opened till the *Seed* is ripe; here the *Vessel* is always open at the top: I say, these *tubulous* Guards of the *Flower*, and Preservers

Preſervers of the *Seed* in the *Labiatæ*, and Surrounders of the Pod in moſt of the *Papylonaceous Flowers*, may be called *Calix* or *Perianthium*, as People ſhall think fit; or if it ſeem good ſtill to keep up the Diſtinction, that part which guards the bottom of the *Flower*, and preſerves the *Seed*, may be called *Calix*, and the expanded part which cover'd the tender *Bud*, and is divided into five pointed Portions after the *Flower* is blown, may be called the *Perianthium*. Thus far I have thought fit to inſtruct the young *Botaniſts*, that they may know where the Diſtinction of *Calix* and *Perianthium* lies, that they be not at a loſs when they hear them term'd ſometimes the one, and ſometimes the other. The *Calices*, or rather the *Perianthia*, are divided into *Monophyllous* and *Polyphyllous*, as the *Flowers* are into *Monopetalous* and *Polypetalous*. Mr. *Vaillant* gives the Diſtinction betwixt them, *viz.* "When "you pull the one from the other, if it be "*Monophyllous*, then they will be torn at "the ſides; but if *Polyphyllous*, then the "ſides ſhall remain entire, even to the *Pe*"*dicle*."

Having thus diſcours'd of the outer and ſurrounding Parts of the *Flower*, *viz.* the *Petala*, *Calix* and *Perianthium*, I come next to its ſurrounded Parts, by Dr. *Grew* called the *Attire*; and theſe are either the *Male Parts*, ſuch as the *Stamina* and *Apices*, or

Female Parts, such as the *Stylus* and *Pistillum*.

The *Stamina* or *Chives*, are several long, small, round Portions, arising either from the inner Surface of the *Petala*, especially in the *Monopetalous Flowers*, or bottom of the *Flower*, surrounding the *Pistillum*, each endow'd with a proper *Apex* or Top, by which they are distinguish'd from the *Stylus*, which either has no *Apex* at all, or if it has, is of a quite different Figure and other Colour, from the *Apices Staminum*, and from a *Capillamentum*, which is either divided or not divided at the upper Extremity, but still without an *Apex*. Mr. *Vaillant* divides them into the *Head*, which is the *Apex*, and the *Tail*. When they arise from the bottom, they are of a quite different Texture and Colour from the coarse Substance of the *Calix*, but consisting of fine and delicate parallel Fibres; are rather of the same Nature with the *Petala*, from which however they may sometimes differ in Colour, yet seldom or never in Texture. Their Number is often the same with the Number of the Segments in the *Monopetalous Flowers*, or the *Petala* in the *Polypetalous* ones, where the Number of the *Petala* is certain and determin'd, especially in the *Tetrapetalous* and *Pentapetalous* ones. Thus I have often seen in *Tormentilla* and *Ruta*, both of which are *Tetrapetalous* for ordinary, that if they had chanc'd to vary, the *Tormentilla*

mentilla had five Leaves in the *Perianthium*, if it became *Pentapetalous*, and *Ruta* had five *Stamina*, and became *Pentacapſular*, if it chanc'd to be *Pentapetalous*. *Camerarius* and Mr. *Vaillant* give us ſeveral Examples wherein the Number of the *Stamina* differ from that of the *Petala*; *Iris* has ſix *Petala* (*Camerarius* calls them nine, miſtaking the *Tripartite Stylus* (*Fig.* 8. 222) for three of the *Petala*) to three *Stamina*, *Gladiolus* ſix to three, *Veronica* two to four *Segments*: The *Tetrapetalæ ſiliquoſæ* ſix to four *Petala*, eight to many of the *Papylonacæ* which have only four *Petala*; *Balſamina*, according to Mr. *Vaillant*, has five *Stamina* to four *Petala*, *Hypocaſtanum* ſeven to five, *Cardamindum* and *Acer* eight to five, *&c.* Where the Number of both *Stamina* and *Petala* are determinate and certain, then it is eaſie for thoſe who are at pains to obſerve them, to find out the Proportion they bear to one another; but few are at pains to ſum up the Number of the *Stamina* or *Petala*, in the *Polypetalous* ones, *i. e.* ſuch as exceed ſix; for beyond that, the Number of the *Petala*, and far leſs of the *Stamina*, is certain, as in *Ranunculi*, and moſt of the *Roſaceous Flowers*; *Chelidonium minus* and *Hepatica Nobilis*, have each for the moſt part eight *Petala*; moſt of the other ſingle *Ranunculus Flowers* are *Pentapetalous*; but neither is that a Rule; and for the *Stamina*, that's altogether uncertain, eſpecially in

in the *Semine Nudo Polyſpermæ*; ſome have ſuch an abundance of *Stamina*, as the *Filipendula*, *Ulmaria*, that Mr. *Ray* by accident called them *Staminei*; for which being call'd in queſtion, becauſe the *Stamineous Flowers* make up a very large *Genus*, he altered the Expreſſion afterwards, and called them *Staminoſi*.

Every one of the *Stamina* has its proper *Apex*; theſe *Apices* are divided into two *Lobes* or *Celluls* of different Figures; thoſe of *Malva* appear to be round to the naked Eye, and thoſe of the *Lillies* and *Iris* are long, (1. *Fig.* 1. *l. Fig.* 2. 2. *Fig.* 9.) thoſe of the *Lillies* have rather four than two *Celluls*, for there are two *Laminæ* join'd together *Longitudinally*, by a *Septum intermedium*, and each of theſe *Laminæ* are folded up towards the *Septum*, the one above the other; the Point of the hollow *Stamen* is fix'd to the Center of the *Septum*; before the *Flower* is blown it enters the forked Extremity, and is ſituated betwixt the two upper *Celluls*, being fixed to the Center of the *Stamen*; but no ſooner is the *Flower* open, and the *Celluls* begin to ſhed the Duſt, than it quits its hold of any other part of the *Apex*, but where its Point is fix'd; and thus 'tis ſo equally pois'd, that it muſt be ſhaken by the leaſt Breath of Wind, and ſo diſperſe the *Farina* by degrees, by the forked Extremity till all the Duſt is ripe; and then the whole *Laminæ* are ſpread forth if it

is

is moist Weather, but in hot and dry Weather they are immediately crumbled up and dry'd. Thus I suppose it fares with all the *Flowers* with long *Apices*; but such as are round or globulous, whose *Stamina* are either crumbled within the *Calix*, or which are so fix'd upon the *Stamen*, that they do not move so easily as the former, the *Membranes* of their two *Celluls* for the most part open with an Elasticity, and shed forth the Dust all of a sudden, as Mr. *Vaillant* has express'd it at large, in treating of the *Parietaria* where the *Stamen* lies hid, and wrap'd up spiral ways like a Cork Screw, that you see nothing of the Flower but the four *Apices* till the Dust is ripe, especially in the Morning, when the Sun Beams begin to beat upon it; then do the *Stamina* extend themselves, darting out as it were the *Apex*, upon which the slender Membranes of the *Celluls* burst, and shed forth the *Farina quaquaversùm*; the same I have observ'd with a great deal of Pleasure in the *Katkins* of the *Mulberry* in the Month of *April*, where these Flowers consist of four *Apices*, and have their *Stamina* crumbled up within the *Calix*, as the *Parietaria*, but several of them are join'd to a *Midrib*, and make up the *Julus* or *Katkin*, of the same Shape with the aggregate Fruit, consisting of several little pulpous or juicy Berries, adherent to one common *Pedicle*, like the Fruit of the *Rubus* or *Bramble*, with this difference, that the *Mulberrys* are oblong,

and

and thoſe of the *Bramble* round or ſpherical; but of this more hereafter.

The *Capillamenta* or *Chives*, are ſaid by Dr. *Tournefort* to be the ſame with the *Stamina*, only that they want the *apices*. They are the ſmall Threads or Thrumbs we obſerve to be lodg'd among the *Corymbiferæ nudæ* and *Radiatæ*; alſo among the *Flore compoſito papeſcentes* and *Lacteſcentes* of Mr. *Ray*, or in the *Flore floſculoſo*, as *Scabioſo ſemifloſculoſo*, as *Sonchus*, *Lactuca*, &c. and *Radiato* as *Calendula*, of *Tournefort*. They are either *Bifida*, or divided into two Portions at the top, or *Simplicia*, whereof hereafter. So ſoon as theſe *Floſculi* or *little Flouriſhes* open, then theſe two Portions ſeparate from each other, and are bended downwards like two Fiſh-hooks. Sometimes they are covered with a *Vagina* or Sheath at the top, which appears blackiſh in the middle of the *Flouriſh*, until it is fully blown, and then the *Sheath* falls off, and the two Portions ſeparate, and both being loaded with a *Farina* or *Duſt* (ſuch as is contained in the *Apices* of other Plants) it is then diſpers'd. The uſe of this upper Sheath (ſo I muſt call it in Diſtinction to that in the lower part of the *Floſculum*) ſeems to be to preſerve the top of the *Capillamentum* till the *Farina* is fully *ripe*. This is very obſervable in the *Flos ſolis*, or *Sunflower* (where it is very obvious;) *Calendula* and ſeveral other *Radiate Flowers*, where the upper

upper *Vagina* is so small, that it requires a Magnifying-glass to observe it. Some compare them to the *Stamina*, but I rather chuse to compare them to the *Stylus* in other Plants; for 1st. They have no *Apices* or Tops. 2dly. They arise from the bottom, and not from the sides of the *Flouriſh*. 3dly. Each of them are situated upon the *Embryo ſeminis*, as the *Stylus* is upon the *Piſtillum* of other Plants. Their number is indefinite, according to the number of the *Flouriſhes* and *half Flouriſhes*; and here it will not be improper to declare what is meant by the Flouriſh and half Flouriſh of a Plant.

A *Flouriſh Floſculum*, is a *Petalon* or *Flower-Leaf*, which (as the *Petala* do in other, eſpecially *double Flowers*) make up the whole Flower. They are long, ſmall, hollow *Tubes*, expanded and divided into five, for the moſt part, pointed *Segments* at the top, either equal, as in the *Corymbiferæ nudæ*, as *Tanacetum*, or in the *diſcus* of the *Radiatæ*, as *Calendula Jacobæa*, &c. or into *unequal Segments*, as in *Scabioſa Cyanus*, &c.

The *Semifloſculi*, or *half Flouriſhes*, are *tubulous* or hollow at the bottom with the former, and ſoon ſpread forth into a *petalon-planum*, a broad, plain, *flower Leaf*. Theſe either make up the whole *Flower*, as in *Dens Leonis*, *Hieraceum*, *Scorzonera*, *Trago-pogon*, &c. or along with the *Floſculi*, make up the *Corymbiferæ Radiatæ*, i. e. when the *Corona*

or

or *Radius*, the utter Border of the *Flower* next to the *Perianthium* or *Calix*, consists of the *Semifloſculi*, and the *diſcus*; the middle part of the *Flower* consists of the *Floſculi*, as in *Calendula*, *Bellis*, *Chryſanthemum*, *Flos ſolis*, &c.

Each of these *Floſculi*, and *Semifloſculi*, are situated upon the top of an *Embryo ſeminis*: At the bottom of each of them arise five small Portions or Columns, all which in a little unite together, and make up a *Vagina* or Sheath, surrounding the *Capillamentum*, which, as is said, arises from the top of the *Embryo ſeminis*. They are either *Bifida*, as above, or *Simplicia* undivided, as in *Scabioſa Centaurium maj.* &c. The use of the Sheath is to receive and contain within Bounds the *Duſt*, as it falls upon the top of the *Embryo ſeminis*.

These being the Male Parts of the *Flower*, whose Use shall be declared hereafter, I now proceed to the *Female Parts*, viz. The *Stylus* and *Piſtillum*; The *Stylus* for the most part accompanying the *Piſtillum*, as the *Perianthium* does the *Calix*, is as much neglected to be mentioned by the Moderns, as the *Perianthium*; but the same Reason holds for using both; for when the *Stylus* and *Piſtillum* meet both together, the *Stylus* is situated upon the *Piſtillum*, but seldom of the same Substance, for when the *Piſtillum* begins to swell, then the *Stylus* takes his leave and

and falls off, which shews they are not continuous, but contiguous to each other.

A *Stylus* then, is a long, small, round Portion, more or less hollow, according to its bigness, placed in the center of the *Flower*, sometimes upon the top of the *Pistillum*, and sometimes not, always without such an *Apex* as the *Stamina* have, but sometimes covered with an *Operculum* or Lid, as in the *Lillies* (*aaa*) and sometimes fimbriated or fringed, being divided into several small Hairs at the upper Extremity, as in the *Mallows* (*f*)

The *Stylus* may be without the *Pistillum*, as in the *Galleatæ* and *Verticillatæ* and *Asperifoliæ*, where the *Stylus* is in the *Center*, and the four *Embryones*, which afterwards become so many Seeds, surround and support it. Dr *Tournefort* in this Case calls it, *Pistillum quatuor Embryonibus stipatum*; though according to his own Acceptation of the *Pistillum*, it does not become the *Fruit*. The *Malva* also has an *Orbicular Fruit*, consisting of several *Capsulæ*, according to Dr. *Tournefort*, or of *Semina nuda, in orbem Rotuli aut Caseoli formam posita*, according to Mr. *Ray*, all which adhere to the *Stylus* plac'd in the middle; and this again is guarded by a *Pyramidal Tube*, upon which the *Apices* are plac'd (*dd*) Now *Tournefort* in this Place neglects the *Stylus*, and only speaks of the *Fructûs rudimentum*, as the *Pistillum*, giving the *Stylus* (*f*) the

(*aaa*) Tab. 1. Fig. 1. (*f*) ibid. (*dd*) Fig. 10. (*f*) Ibid.

Term

Term of *Axis Medius*, which plainly ſhews, that the *Stylus* and *Piſtillum* are two diſtinct parts of the Flower.

Camerarius indeed ſpeaks of the *Stylus* and *Piſtillum*, as one and the ſame, and only makes the *Stylus* the upper, and the *Piſtillum* the lower part of the *Embryo Fructûs*: *Simultaneum iſtum petalorum apicumque exortum ſequitur brevi tempore ſimilis dilapſus, & tum Styli ſuperſtitis partem inferiorem intumeſcere, ſuperiorem autem quaſi Infundibulum paulatim marceſcere notant* Botanici.

But as I hope I have made it obvious, that the *Stylus* and *Piſtillum* are for the moſt part two diſtinct Portions, and that there may be a *Stylus* without a *Piſtillum* at leaſt under it, ſo there may be a *Piſtillum* without a *Stylus*, as in the *Papaver*, &c. In a word, according to Mr. *Tournefort*'s Method, the *Piſtillum* is that part which becomes the *Fruit*, which the *Stylus* never do's, and it is always ſituated within the *Flower*, as the *Calix* is without it.

I have hitherto neglected to give the Uſe of all theſe Parts, becauſe I ſhall treat of it elſewhere, I now proceed to the general Conſideration of the Flowers themſelves, and ſhall divide them either in reſpect of their Structure or Uſe.

In reſpect of their Structure, they are either *Monopetalous*, *Polypetalous* or *Apetalous*, and *Stamineous*, I rather chuſe to divide them thus,

thus, than with Mr. *Vaillant* to divide them into *True* and *False*, *Complete* and *Incomplete*, *Perfect* and *Imperfect* ones; for in my Opinion, no created Being can be called *Imperfect*, so long as it consists of all those Parts by which it was design'd to be propagated and preserv'd at the *Creation*; and we are not to look upon those called *Apetalous*, or *Stamineous Flowers*, as *imperfect*, because they are not endow'd with those beautiful *Petala*, by which they are render'd so obvious and so delightful to the Eye: Nor upon those called *barren Flowers*, as the *Cucumers* and *Melons*, as *incomplete*, because when they fall off they leave no Fruit behind them. *God* who is the *Author* of Nature, or *Nature* it self, *viz.* That second Cause by which one Effect produces another towards the Generation, Preservation, and Propagation of any *Created*, whether *Animated* or *Inanimate* Being, never do's any thing in vain; and if these our Author calls *Incomplete* or *False Flowers*, do answer the Uses for which they were at first design'd, and consist of Parts fit for that Purpose, I see no Reason why such a Plant should be called *Imperfect*, for that would imply that it wants some Parts which hinders it from performing those *Offices* for which it was at first design'd; but of this more hereafter.

A *Monopetalous Flower*, is that which has *one Petalon* or *Flower-leaf*; they are

for the most part divided into five *Segments* at the Border, or a little deeper; but sometimes into three, as in the *Unilabiatæ*, as *Scordium* when the four *Stamina* supply the *upper Lip*. *Anomala* as *Acanthus*, when the Leaves of the *Perianthium* supply the upper Lip; sometimes into four *Segments*, as the *Veronicæ species*, and sometimes they are not divided at all, but being *Tubulous* at the bottom, they are afterwards expanded towards the Extremity, ending in a sharp Point, as *Arum*, *Aristolochia*, &c. and sometimes not expanded, blunt at the Extremity, as *Digitalis*; but the various Figures of *Flowers* are extrinsick from my Purpose, I shall only add, that *Monapetalous Flowers* are sometimes so deeply divided, that they can scarcely be distinguished from *Pentapetalous* ones: Thus *Malva* has been by some mistaken for a *Pentapetalous* Flower. And Mr. *Ray*, to reconcile the matter, calls it *Pentapetaloid*; and *Oxys s. Trifolium acetosum*, is by most Authors reckon'd *Pentapetalous*, though Dr. *Tournefort* calls it *Monopetalous*. The common way of distinguishing the *Monopetalous* from the *Polypetalous Flowers*, is to observe whether it falls off together, or in several Portions. Mr. *Vaillant* gives the following distinguishing Marks: 1st, If the *Calix* is *Monophyllous*, then the Flower is *Monopetalous*. 2dly, If the *Stamina* must be separated from the sides of the *Petala*, then 'tis *Monopetalous*,

lous, as in *Gentiana*, *Campanula*, and most, if not all of the *Lip-flowers*; but if the *Stamina* immediately arise from the bottom of the *Flower*, as in the *Lilly*, then the Flower is *Polypetalous*.

The *Polypetalous Flowers*, are such as consist of more *Petula* than one: Thus they are *Bipetalous*, as *Circæa*, which is the only *British* Plant, I know of, that is so. *Tripetalous*, as *Phalangium Virginianum*, *Plantago*, *Aquat. major* and *minor*. *Tetrapetalous*, as *Papaver*; all the *Tetrapetalæ*, *Siliquosæ* and *Siliculosæ*. *Pentapetalæ*, as several of the *Rosaceous Flowers*, viz. *Ranunculus*, *Pentaphylla*, *Umbelliferæ*, and the *Flores Caryophylli* of *Tournefort*. *Hexapetalæ*, as the *Lillies*, and all the *Lilliaceous kind*. The *Iris* and *Xyphion*, or *Iris Bulbosa*, is truly a *Monopetalous Flower*, divided into six *Segments*; and I supect there are several others of the *Lilliaceous kind Monopetalous* too, and therefore *Tournefort* being aware of this Objection, says, he has not establish'd this *Class*, because that all of them are *Hexapetalous*, but because all of them have a *Tricoccous Fruit*, or a *Fruit* divided into three *Loculamenta* or *Pouches*. I have already observ'd, that *Camerarius* calls *Iris*, *Enneapetalous*, being led into this Mistake by Mr. *Ray*, who once said so, which he afterwards retracts. The Truth is, at first Appearance the *Iris* seems to have nine *Petala*,

but if any one ſhall trace the *Stylus*, they'll find it to ariſe by a ſmall, long, round Portion from the *Calix*, and to be contain'd for half an Inch length within a green *Vagina* or Sheath, till it arrive at the bottom of the *Flower*, where 'tis expanded into three narrow, bifid *Petala*, lying horizontally in the middle of the *Flower*, each hiding a *Stamen* below it: Another Reaſon why it's *Monopetalous* is, that it is *Flos non caducus*, which no *Polypetalous Flower* is. After the number of the *Petala* has come the Length of ſix, it is never afterwards determin'd, but all paſs under the Name of *Polypetalous*.

The *Apetalous* or *Stamineous Flowers*, are a large and numerous *Claſs*; they conſiſt of the *Calix* or *Perianthium*, and ſeveral *Stamina*, with their *Apices*, without any *Petalon* or *Flower-leaf*. Some of them have a *Capſular Fruit*, as *Aſarum*, *Beta*; others have one ſingle Seed ſucceeding to each Flower, as *Acetoſa* and *Lappathum*, where there's an *Hexaphyllous Calix*, with ſeveral *Apices*; three of the Leaves of the *Calix* being broader, are enlarg'd afterwards, and become the *Capſula*, to a three-corner'd Seed, and the other three become the Baſe of the *Fruit*. The *Acetoſa Britannica*, of which I have diſcours'd at large in my *Miſcellaneous Obſervations*, has a *tetraphyllous Calix*, and a flat, inſtead of a *triangular Fruit*. *Tournefort* ſays, There are ſome Species of the *Atriplex*, whoſe

whose Flower arises separate from the Fruit; *i. e.* has *Male* and *Female Flowers*: The same is also observable in several Species of the *Acetosa*, as in the *Arvensis Lanceolata*, *Pratensis*, *Vesicaria*, &c. though he makes no mention of it. He justly makes two distinct *Genera* of the *Atriplex*, the one with a *flat Fruit*, which he calls *Atriplex*, and the other with a *starry Fruit*, among whom is *Atriplex fœtida*, and *Bonus Henricus*, *Blitum*, *Herniaria*, *Paronychia*, *Achimilla*, *Parietaria*, &c. with which Mr. *Vaillant* makes such a Work. All these have one *Seed*, succeeding an *herbaceous* or *greenish Flower*; but there are some Species of the *Persicaria*, *Potamogeitons*, *Polygonum*, *Bistorta*, &c. whose *Calix* consisting of finer *Leaves*, and a brighter Colour, may at first View be mistaken for petalous Flowers. That large Tribe of *Flowers*, consisting of the *Frumenta Semine Esculento*, or *Farinaceo*, as *Triticum*, *Hordeum*, &c. which are *Spicata*, when many of their *Flowers* and *Seeds* are compactly join'd together, and are adherent to a *Mid-rib*, or *Axis-medius*, or *in Fasciculos Pendulos Dispositа* as *Avena*, *Paniculata*, as *Milium*, *Panicum*, &c. and the *Gramina Semine non Farinaceo*. All these have a *Stamen*, with a large *Apex*, which are the Forerunners of each single Seed. The third *Genus* of *Apetalous Flowers*, are such as arise in separate Parts from the Fruit, in the

ſame Species as *Cyperoides*, *Typha-Mayes* or *Turky-Wheat*, &c. of which Mr. *Geoffroy* gives an account in the *French Memoirs*, viz. that there firſt appears a Spike of *Flowers* upon the top of the Stalk, which ſo ſoon as they are decay'd, there appear two or three Bundles of ſmall Threads, which are the *Stylus* of the *Seeds*, hid as yet in *Foliorum alis*; but they afterwards ſwell and become a Fruit, conſiſting of a great many *Seeds* upon a long *Spike*. The fourth kind of theſe *Apetalous Flowers*, are ſuch as ariſe upon different Plants, of the ſame Species, *i. e.* ſome Plants will produce Spikes of Flowers, to which no Fruit or Seed ſhall follow, when others ſhall have ſmall *Globules*, ſeveral of which ſhall be compactly join'd together, which afterwards become the Seed without any previous Flower, as *Cannabis Mercurialis*, *Spinachia*, *Urtica*, *Lupulus*; though ſome Species of the *Lupulus* ſhall have Spikes of the Flowers and Fruit, and other Plants ſhall have *Globules* of the Fruit or Seeds, upon the ſame Stalk, as *Urtica Romana*, &c.

There are alſo ſeveral Trees, whoſe *Apetalous Flowers* ariſe in different Branches of the ſame Tree, or in different Trees of the ſame Species. Several of theſe *Flowers* are ſometimes more compactly, at other times more looſely join'd together upon an *Axis-medius*, or *Mid-rib*, and this *Cluſter of Flowers*, as I may call them, is called Ἰξλον in the

the *Greek*, *Julus* and *Amentum* in the *Latin*, *Chaton* in the *French*, and *Katkins* in the *Engliſh*. They are either *pendulous* or *hanging downwards*, as in the *Avellana*, *Corylus*, *Nux juglans*, &c. where one, two or three greeniſh, or herbaceous, ſmall, round Leaves are placed upon a ſmall, ſhort Pedicle, ariſing from the *Coſta-media*, *Axis*, or *Middle-rib* : Theſe *Leaves* are convex above, and being concave below, cover ſeveral little *Stamina*, or rather *Apices*, which compoſe the *Flowers* ; theſe *Flowers* are thick ſet and regularly diſpos'd upon this *Axis* or *Mid-rib* (which ariſes from the Branch, and for the moſt part appears before the Trees are broke, *i. e.* before the Leaves are puſh'd forth) and hangs ſo looſe, that the leaſt Breath of Wind ſhall make them ſhake, of which the ingenious Mr. *Bradly* gives this handſome Account. " This *Tree*, ſays he, " *viz.* the *Hazel* or *Philbud*, in *January* " puts forth what are commonly call'd *Kat-* " *kins*, which are long *Thrumbs*, compos'd " of very *ſmall Flowers*, which towards the " beginning of *March* are cover'd with a " fine *Duſt*, or *Male-ſeed*; 'tis then the *Bloſ-* " *ſoms* or Female Parts appear on the Buds " of the ſame Tree; they are very ſmall, " and hardly to be diſcern'd without ſtrict " Enquiry, only offering to the View a ſmall " Cluſter of Scarlet Threads, which are ſo " many *Tubes* leading to the *Rudiments* of

" the *Nuts*: This happens at a windy Sea-
" ſon of the Year, that the Male Duſt may
" be the more eaſily convey'd to the *Utri-*
" *cles*, or *Female Bloſſoms* of the *Plant*".
There are other *Juli* which are not pendu-
lous, or hanging downwards, but when the
new *Stolones* or freſh Shoots of the *Tree*, *v. g.*
in the *Firr* and *Pine-tree*, do begin to extend
and be lengthen'd, then it is that theſe *Juli*
or *Cluſters* of thick-ſet *Flowers*, conſiſting
of fine, ſmall, yellowiſh *Leaves* of the *Ca-*
lix and ſeveral *Apices*, do not adhere to a pro-
per *Mid-rib*, but are plac'd round the new
Stolones; theſe are blown about the middle of
May, and ſhed their Duſt towards the latter
end of that ſame Month. There was Rea-
ſon for the *Juli* of the other to hang down-
wards, to be ſo much expos'd to the Wind, and
to ſhed their Duſt ſo early, becauſe the Leaves
would have afterwards hindred the Duſt from
falling upon the *Embryones*, and the *Fruit*,
is alſo ripen'd in the ſame Seaſon; but for the
Firr and *Pine-trees*, they being Ever-greens,
and uſually having their *Cones* a Year upon
the Tree before it is ripe, there is no need of
ſo early a Seaſon for them, nor to be ſo tick-
liſhly plac'd as to be ſhaken with every Wind,
nor of ſuch haſte to ſhed the Duſt, becauſe
their Apples take time to grow. Flowers may
be otherwiſe diſtinguiſh'd, according to their
Sexes, but we ſhall leave that, as alſo the decla-
ing of the Uſe of this Duſt, to another Part.

BOTA-

BOTANICK ESSAYS.

Essay II.

Upon the Fruits of Plants.

A *Fruit* is an *annual* Part of a Plant, adhering to, and succeeding the *Flower*, and containing the *Seed*; which when ripe, or come to perfection, falls down of its own accord, if not timely pull'd from the Plant.

Though it be said to be *annual*, yet there are some *Fruits* which will remain two Years upon the Tree, as *Figs*, *Oranges*, *Lemons*, *&c.* as also the *Pine* and *Firr Apples*; but these singular Examples are no Objections against a general Definition.

Fruits are either *esculent*, *i. e.* when that Substance which surrounds the *Seed* is eatable by Man; though it seldom becomes a convenient Food: They are;

1. *Pomiferous:* And these are such as grow upon *Trees*, which consist of a thick and firm *Parenchyma*, or fleshy Substance, surrounding five *membranous Celluls*, containing so many Seeds, as in Apples, properly so called, Pears, *&c.* or whose *Parenchyma* is loose, spongious and juicy, containing the *Seeds* in the middle, as in *Oranges*, *Lemons*, &c. The *Herbaceous Pomiferæ* are oblong; larger, as *Pompions*, *Gourds*, *Melons*, &c. or lesser Apples, as *Cucumbers*; all which have a firm *Parenchymatous* outer, and more spongy, juicy and *cellulous* inner Substance, in which a great many Seeds are lodg'd.

To these *Pomiferæ* may be added the *Fig*; which although it be a *Fructus sui generis*, yet in regard of its Bigness, Figure, and *Parenchymatous* Substance, not so juicy as the *Baccæ*, may as well be clas's'd among the *Pomiferæ* as among any other kind of *Fruit*. This singular *Fruit* contains its Flowers in the middle; as has been obsery'd of old by *Cordus*, and more particularly of late by *Mr. de la Hire*, as in the Memoirs of the Royal Academy at *Paris*, *an.* 1711. who says, that in the middle of the *Fig* there are a great many *pentaphyllous* or *tetraphyllous Calices*, which arise

ariſe from the inſides of the *Fruit*, and are endow'd with a great many *Stamina* and *Apices*, with the *Piſtillum* or *Stylus* in the middle, to which ſucceed ſeveral ſmall *Seeds*.

2. *Bacciferæ:* The *Berries* are diſtinguiſhed from the *Apples:* 1. In their Bigneſs; the *Berries* being much leſs than the other: 2. They are of a more lax Texture, and more juicy, having their *Seed* not lodg'd into diſtinct *Celluls*, as moſt of the *Pomiferæ* are, but diſpos'd indifferently amidſt the inner *Pulp*, as in the *Grapes*, *Gooſeberries*, *Currans*, &c. which grow upon Shrubs; for the Vine can be reckoned no other, unleſs by its high Aſcent, by means of the *Claviculæ* or *Climbers*, by which it graſps Trees, Poles, or what elſe is next to it: There are alſo *Bacciferous Trees*, ſuch as the *Morus*, *Myrtus*, *Laurus*, *Sambucus*, &c. and *Bacciferous Herbs*; and theſe are *Magis Sparſi*, as in the *Aſparagus*, *Solanum*, &c. or *Coacervati*, as *Arum*, *Dracontium*, though Mr. *Ray* is pleas'd to claſs both together, under one and the ſame *Title*; they may alſo be ſaid to be *aggregate*, as in the *Morus* and the *Rubus*, when a great many ſmall *Globules* join'd together make up a *Fruit*. There are alſo *Berries* of a more dry Subſtance, as the *Baccæ Juniperi* and *Oxyacanthæ* or *Hawthorn Berries*.

3. *Teſtaceæ* or *Stone Fruit:* Theſe are ſuch whoſe external Subſtance is *Parenchymatous*; in

in ſome more firm, as *Apricocks*, *Peaches*, &c. others longer and more juicy, as the *Plumbs* of all ſorts; and others more round and leſs, as *Cherries*, &c. all theſe have a hard Stone in the middle, containing one ſingle Kernel or Seed. Theſe Stones conſiſt of two equal Portions ſo firmly united, that no Art can ſeparate them without breaking the Shell; but when put into the Ground, the Seed or Kernel begins to ſwell, and to be dilated, in due time, by which the two ſides of the Stone are forc'd from each other, and the Seed is thus freed from its *Clauſtrum* or Priſon.

With the Stone Fruit may alſo be reckoned the *Nuciferæ*, or *Nut-bearing Trees*, ſome of which are covered with a thick, ſmooth, outer Rind, and hard Shell, as the *Walnut*; others with a rough one, but *membranous* Shell, as *Cheſt-nut*; and others have a hard Shell, and *membranous* outer Husk, as the *Avellana* and *Corylus*, the *Filbud* and *Haſel-nuts*.

I come next to the *Fructus non Eſculenti*, the not-eatible Fruit; but before I conſider them, I ſhall take notice of the *Seeds*.

A *Seed* is that part of a *Plant*, which when committed to the Ground, or fix'd in any other convenient Place, it is enlivened, takes Root, by which it receives Nouriſhment, and produces a new *Plant*, like unto that from whence it came; for as Earth is ſaid to be

be the Mother of us all, ſo it is ſuch in a ſpecial manner to the Seeds of Plants; which can make no Step or Progreſs towards the Propagation of the Species, until being buried in the Ground it there dies, and a new Plant takes Life as it were, or ſends forth its *Fibres* on purpoſe to receive a competent Supply of Nouriſhment, and ſo propagates the Species: For as we are told in *Geneſis*, that the *Herb bears Fruit whoſe Seed is in it ſelf*, ſo St. *Paul* tells us in the *Corinthians*, that the Seed which is ſown muſt die, before the Plant to be produc'd by it can take Life, *but God*, ſays he, *giveth it a Body as it hath pleaſed him, to every Seed his own Body.*

There are the *Seeds* of ſome *Trees*, which falling in betwixt the Clefts of a *Rock* where there is ſcarce any Earth, the Tree will there take root and grow; and I have obſerv'd how the *Viſcum* will not take root in the Ground, but by the placing of its *Berry* upon ſome other Tree, it grows, and is propagated there: But be that how it will, the Earth, either mediately or immediately, furniſhes Nouriſhment to all kinds of Vegetables. It may be ſaid indeed, that the *Lithophytæ* do not receive their Nouriſhment from the *Earth*, but from *Rocks* and *Stones*; but it can be anſwered, that even the *Rocks* and *Stones* are *Earth* to ſuch Plants in that reſpect; and to ſeveral other *Sub-marine Vegetables* of a ſofter Texture than they are.

The

The *Seeds* of Plants are either *Nuda* or *Capſulis incluſa*. Some have a great Difficulty in admitting of thoſe commonly called *Semina Nuda* or *Naked Seeds*; and therefore the *Naked Seeds* by ſuch are thus defin'd; *viz.* That a *Naked Seed*, properly ſpeaking, is that whoſe *Seminal Leaves* are only covered with a proper or a ſingle Coat, and no more, according to that of *Cæſalpinus*, "That in all *Seeds* there is a certain "fertile Humour or Subſtance, which if it "periſh, or by Age or any other Accident "it is render'd fruitleſs, no Plant can be propagated from it: Therefore to prevent "ſuch Inconveniencies, Nature has provided "each Seed with its proper Coat, with "which it's conſtantly involv'd till it begin "to *Bud*[a]." That it's neceſſary that every *Seed* ſhould be endow'd with its proper Coat is what ſhall not be deny'd; but why, becauſe it has another looſe Coat ſtill to preſerve the *Germen* of the *Seed* from external Injuries, it ſhould not be called *naked* I ſee no reaſon; *v. g. Peaſe* and *Beans* are *Capſulis* or *Siliquis incluſa*, yet every one of them have an outer and inner Coat; and becauſe of that, ſhall not theſe be call'd *Naked Seeds*? That's going a little too nicely to work: though I think Mr. *Ray* is too much upon the Reverſe, when he ſays, that he accepts of the

[a] Knaut. de Method. p. 26.

whole

whole *Fruit* for a *Naked Seed*. *Tournefort* ſays, he diſtinguiſhes betwixt the *Shell*, and the *Seed* contain'd within the *Shell*. " But, ſays Mr. *Ray*, " if no Seed can be look'd up- " on as naked, except that which has a ſin- " gle, yea, a double Coat, there is no ſuch " thing upon Earth as a Naked Seed[b]". Now that there are *Naked Seeds*, which have only one *Coat* from the *Frumenta* or eatable Grains, as *Wheat*, *Barly*, *Rye*, is plain, unleſs you'll call the *Gluma* the *Chaff* a *Capſula*, and we know that *Barly* has but little of that: again, I am willing to admit of all the *Umbelliferæ* having *Naked Seeds*, though *Tournefort* ſays of ſome of them, that they have *Semina involucrum deponentia*; but I will not ſo eaſily accept of the *Agrimonia* and *Circæa*, as having *Semina Nuda*, even although with Mr. *Ray* they be claſs'd among the Plants *Seminibus Nudis Solitariis*, whereas he owns, that *Agrimonia* has *Vaſcula Lappacea*, *duo ſemina plerumque continentia:* now in this Caſe, *Agrimonia* can neither be ſaid to have a *ſolitary naked Seed*, nor one *ſingle Seed* to ſucceed to each *ſingle Flower*. *Moriſon* in his *Hiſt.* and *Hallucinationes*, would have *Circæa* and it claſs'd together, becauſe they have *Semina Verrucoſa:* he means, they have a rough *Capſula*; and *Flora Batava* reckons the *Circæa*

[b] Ray Meth. Emend. p. 126.

among the the *Angioſpermæ*, and the *Agrimonia* among the *Monocarpæ* [c]; ſo that with reſpect to the Fruit both may be claſs'd together, but none of them can enter among the *Semina Nuda ſolitaria ad ſingulos Flores*: Some of the *Trifoils*, as *Trifol. Pratenſe Purpureum*, are *Monoſpermæ*; but it is look'd upon as a *Capſular* Fruit, as are all the other *Trifoils*, *Lotus*, *Melilotus*, *Medica*, &c. and although both *Fruit* and *Seed* fall together, yet ſuch *Trifoils* as are *Monoſperma*, cannot be ſaid to have a *naked Seed*, according to that of *Rivinus*, ſpeaking of *Fumaria*, "And "indeed, ſays he, its *Seed* may ſeem to be *na-* "*ked*, becauſe it does not throw off its Cover "of its own accord, although it be very ripe "when it falls; as the *Melilotus minima fructu* "*renalis ſeu reniformis nigro*, is not ſaid to "have a *naked Seed*, although after the ſame "manner the *Seed* falls down with the *Husk*; "ſo that here they do not err, who ſtrictly "examining the *Fumaria*, ſhall reckon it a- "mong the *Siliquous Plants*, when each ſin- "gle *Silicula* contains a ſingle *Seed* [d]." And Mr. *Ray*,

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[c] Ex *Circis* & *Agrimoniis* peculiare genus componi nempe unicapſulare dyſpermum & generi plantarum unicapſularium ſubjungi non videtur adeò incongruum. Flora Batav. p. 206.

[d] Et ſanè ſemen fumariæ pleriſque videbitur nudum ideo, quia ſuum ſponte non exuit involucrum quamquam ſatis maturum decidat. Quemadmodum verò *Melilotus*, *e. g. Minima fructu renali nigro* non dicitur ſemina geſtare nuda quamvis eodem modo ſuum cum integumenti demittat ſemen

Mr. *Ray*, in his *Methodus Emendata*, says of *Malva*, That in his *Nova Methodus*, and in his *History of Plants*, he had class'd it with the *Gymno-Polyspermæ*, or those Plants which have many naked *Seeds* together, not through Ignorance, because he took the *Seed Vessel* for the *Seed*, as *Tournefort* alledges; "for I "know, says he, that *Cæsalpinus* attributes "a *single Husk* to each *single Seed* of the "*Malva*, and by that distinguishes them "from *naked Seeds*, as appears from the "*Synopsis* of *Cæsalpinus*, his *Method* annex'd "to the *Nova Methodus*; but that which "Mr. *Ray* reckoned for a *naked Seed*, what-"ever, when ripe, naturally falls off from the "common Mother or *Placenta* separately, "and that along with the *Capsula* or *Husk*: "But although in this respect it agrees with the "*Gymnospermæ* or *naked Seeds*, yet because "of the Figure of the *Flower*, and its *Pi-"stillum*, and that the *Seeds* themselves are "easily depriv'd of the *outer Coat*; as al-"so since it agrees by its emollient Virtue "with the *Alcæa Indica*, he thinks it should "not be separated from it [e]." In a word, though

men ita & hoc in loco non aberrabit qui rigorosius examina unicis illam annumerabit siliculosis quæ singula semina singulis inclusis siliculis gestat.

[e] Hanc plantam (malvæ scil.) in methodo meâ & historiâ plantarum plantis gymnospermis polyspermis accensui, non quòd per ignorantiam capsulam pro grano haberem, ut existimat Tournefortius; novi benè Cæsalpinum malvarum seminibus singulis singulos folliculos tribuere, & à seminibus nu-

though I ſhould be unwilling to deny ſuch as have formerly been receiv'd for *naked Seeds*, to be claſs'd among the *Gymnoſpermæ*, in order to avoid Confuſion, yet I do not think thoſe who have a *Capſula* or *Siliqua*, ſhould, without ſufficient ground, be admitted among the *naked Seeds*, when the contrary is plain, and when by ſo doing, ſuch and ſuch a *Species* muſt needs be ſeparated from its *Congeners*, which are *Capſular*, as in the former Examples of the *Trefoils* and *Melilotes*, as alſo the *Malva's*, whoſe *Capſula* are very plain.

Vaſculum Seminale or a *Seed Veſſel*, is either called *Capſula* or *Siliqua*. Theſe are often us'd reciprocally to ſignify the ſame thing; but in my Opinion they ſignify two different things, or at leaſt a *Siliqua* may be called a *Capſula*; but there are *Capſulæ* which are not *Siliquæ*. Both are otherways term'd; *Vaſculum Seminale*, *Conceptaculum* and *Involucrum Seminale*, or *Seminis Folliculus*, *Theca*, &c.

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dis ea diſtinguere, ut patet ex ſynopſi methodi Cæſalpinianæ quam methodo meæ ſtirpium novæ, 1682. editæ ſubjunxi; ſed quòd pro ſeminibus nudis habuerim quæcunque per maturitatem à matribus ſuis ſingulatim ſponte ſeparantur & abſcedunt, ut alibi latiùs expoſui. Verùm quamvis hoc reſpectu cum plantis gymnoſpermis convenit, quoniam tamen floris formâ, ejuſque piſtillo, & ſeminibus ipſis, exteriore integumento, & foliis, totiuſque plantæ habitu, quin & vi emolliente cum Alcæa Indicâ convenit, minimè ab eâ ſeparandum agnoſco, ſecundum regulam mihimet ipſi & aliis præſcriptam. Raii Meth. Emend. p. 86.

I therefore look upon *Tournefort*'s Definition of a *Capſula* to be too general, when he ſays, it's a *Theca* or *Cover* to the *Seed*, whether it be groſs or ſmall, hard or ſoft. I rather take a *Capſula* to be a *membranous*, *ſhort* or *round Veſſel*, containing the *Seed* till 'tis ripe; and either opening of its own accord, and ſhedding the *Seeds*, as *Nicotiana*, *Hyoſcyamus*, *Antirrhinum Delphinum*, *Scrophularia*, &c. or carried along with the *Seed* it ſelf, as we have obſerv'd in the *Fruit* of the *Malva*; and theſe are either *Singulares*, or when one *Capſula* ſucceeds to each *Flower*, as in the foregoing Examples; or *in Capitulum Congeſtæ*, as *Aquilegia*, *Helleborus niger*, *Caltha paluſtris*, &c.

The *Capſulæ* are conſidered, 1. In reſpect of their *Structure*; in which caſe they are either *Simple* or *Compound*.

The *ſimple Capſulæ* are thoſe which have one *Cavity*, in which the *Seeds* are contain'd, as in the *Caryophyllus*, *Lychnis*, and all the *Flores Caryophyllæi* of *Tournefort*, *Primula veris*, *Auricula Urſi*, *Anagallis*, &c.

The *Capſulæ compoſitæ* are diſtinguiſhed according to the Number of the *Loculamenta* or *Pouches*; thus they are *Bicapſulares* or *in duo Loculamenta diviſi*, as *Lyſimachia*, *Sedum bicorne*, *Verbaſcum*, *Blattaria*, &c. *Tricapſulares*, as *Lilium*, *Tulipa*, *Iris*, and all that *Claſs* of the *Flores Liliacei* of *Tournefort*, *Tetra-capſulares*, or divided into four

Pouches, as *Ruta*, *Stramonia*. This *Ruta* is juſtly obſerv'd in the *Flora Batava*, to be *interdum Quinquecapſularis*, as *Geranii Species*, each of which contain only one ſingle *Seed*; and therefore may be ſaid to have *Semina Nuda*, as well as *Agrimonia*. There are other *Pentacapſular Plants*, whoſe *Pouches*, containing ſeveral *Seeds*, open with an *Elaſticity*, and diſperſe the *Seeds* with force, as *Balſamina Fœmina*, *Trifolium Acetoſum*; *Ketmia* alſo, though it have a mallow Flower, may be juſtly reckoned among theſe *Multicapſulares*, as well as *Ariſtolochia*. I do not incline, as others do, to reckon the *Papaver* among theſe, becauſe it has ſeveral *Placentæ* or *Lamellæ*, in which (running longitudinally) the Seeds are lodg'd; but they are not diſtinct *Loculamenta* or *Pouches*, and therefore *Papaver* is only an *Unicapſular Plant*. Several of theſe *Multicapſulares* may alſo be called *Multiſiliquæ*, as having ſeveral diſtinct *Pouches* or *Pods*, not ſeparated from each other by a *Septum intermedium*, but are plainly *Bivalves*, as moſt of the *Siliquæ* are, each conſiſting of a proper *membranous Coat*, and opening longitudinally; and theſe being *in Capitulum Congeſta*, as has been already obſerv'd, may either be *Multiſiliquæ* or *Multicapſulares*, as *Sedum*, *Aquilegia*, *Helleborus*, *Pæonia*, &c.

2. *Capſulæ* may be conſidered in relation to their *Subſtance*; in which reſpect they ma

may be divided into *Carnoſæ*; as the *Pomiferæ* and *Membranaceæ*; but this Diſtinction can ſcarcely be admitted, becauſe however the *Capſular* Fruit may be called *Parenchymatous*, yet the *Capſulæ* are ſtill *Membranaceous*, conſiſting of firm, hard, tough, membranous Sides, capable to ſupport the heavy Load of *Parenchyma* or fleſhy Subſtance, in which they are lodg'd, and which reſt upon them.

3. In reſpect of the Number of Seeds they contain; as *Capſulæ Monoſpermæ*, having only one Seed, as in ſome or moſt of the *Trifoils*; *Diſpermæ* as *Agrimonia*; *Tetraſpermæ*, or *Gymno-Tetraſpermæ* of the *Flora Batava*; as in the *Labiatæ*, ſuch as *Lavendula*, *Hyſſopus*, *Salvia*, &c. and *Aſperifoliæ*, as *Borrago*, *Bugloſſum*: And here it may juſtly be queſtioned, whether theſe may be called *Capſula's*, or only *Vaſcula ſeminalia*, becauſe I look upon a *Capſula* to be cloſe ſhut up till the Seed is ripe; and here the Veſſel is always open, though *Tournefort* is pleas'd to call theſe *Capſulæ quæ Floris calices fuerunt*: And *Polyſpermæ*, when there are many *Seeds* contain'd in one *Capſula*, whoſe Number is indefinite.

The *Capſulæ* have belonging to them the *Septa intermedia*, and the *Placentæ*. The *Septa intermedia*, are as it were *partition Walls*, running from the one ſide to the other, and dividing the *Capſula* into ſeveral

Apartments, called *Loculamenta* or *Pouches*; and upon that account it is that they are called *Bicapſulares*, *Tricapſulares*, &c.

The *Placentæ* are certain Subſtances to which the Seeds adhere, and from whence they receive their Nouriſhment: Sometimes they ariſe from an *Axis medius*, or an *Axle-tree*, (called by the *French Pivot*,) fram'd by the Conjunction of the three *Septa*, which meet in the *Center*; and to this *Axis* is fix'd the *Placenta*, which occupying the middle Cavity of each of the *Loculamenta*, is there loaded with Seeds on all ſides, as in the *Campanula*. Each of theſe *Loculamenta* open either at the top or *longitudinally*, as the *Seeds* ripen, and ſeparate from the proper *Placentæ* or *Seed-beds*. Sometimes the *Placenta* occupies the Center of the *Unicapſular* Fruits; and theſe generally open tranſverſely when the *Seeds* quit their hold, and are ripe, as in the *Anagallis*; and ſometimes they ariſe from the ſides of the *Capſula*, and run towards the Middle; but not meeting in the Center they are only *Unicapſular*, as in the *Papaver*; though the *Flora Batava* calls it *Multicapſular*, becauſe of the ſeveral longitudinal *Lamellæ*, to both ſides of which the Seeds adhere, and are pour'd out, when ripe, at ſo many Holes at the top, (covered with an *Operculum* or *Lid*,) as there are *Interſections* by the *Lamellæ*, which ſcarce happens to any other *Unicapſular Fruit*; upon which account I ſup-

I ſuppoſe it is, that *Herman* did not think it fit to reckon it among the *Unicapſulares*.

I next conſider the *Siliquæ* or *Pods*. Theſe are long, round, or flat *Seed Veſſels*, each containing one or two Rows of Seeds; ſome are *Bivalves*, *i. e.* divided longitudinally into two Parts, opening at the one or foreſide, and having the *Seeds* adherent to the other, as in the *Chelidonium majus* and *Glaucium*, or *Papaver Corniculatum*; wherefore I think they ought to be disjoin'd from the other *Papavers*, notwithſtanding of the *Perianthium Bifolium*; others are *Univalves*, as *Clematis Daphnoides*; Some are *Lanuginoſæ*, as *Aſclepias*, *Acpocinum*; and others *Tetracapſular*, and *Quadrivalves*, as *Chamenerion*, &c. Moſt of that Genus of Plants called *Flore Cruciformi donatæ* of *Tournefort*, and the *Tetrapetalæ* of other Authors, are either *Siliquoſæ* or *Siliculoſæ*; and all the *Leguminoſæ*, or *Flore Papillonaceo donat.* are *Siliquoſæ*.

The *Siliquæ* are likewiſe conſidered as to their *Articulations*; ſo they are either *Siliquis planis* or *Articulatis*, as *Rapiſtrum ſiliqua plana*, and *Siliqua Articulata*: Alſo among the *Papillonaceous Flowers*, there is *Piſum* with a *Siliqua Plana tumida*, *Phaſeoli Siliqua Compreſſa*; *Ornithopodium*, *Orobus*, *Siliqua Articulata*.

N. B. Articulus in *Botany* ſignifies ſeveral *Joints* or *Knots*, by which one part of the

Pod is distinguish'd from another, as if they had been formerly join'd together, as in *Securidaca.*

There are likewise *Siliquæ Cochleatæ* and *Falcatæ*, as the *Medicas.* These are seldom or never called *Capsulæ* but *Siliquæ*, because of their being *Bivalves.*

I may also reckon among the Fruits, the *Capita* or Heads of the Plants, because they contain a great many *Seeds* within one *Theca* or *Cover*; such as the *Capitatæ*, as *Carduus*, *Cinara*, *Jacea.* These having a *Pappo* or *Down*, are called *Papposæ.* The *Corymbiferæ*, which are *non Papposæ sed seminibus solidis*; and these are either *Nudæ*, as *Tanacetum*, *Absynthium*, *Abrotanum*, &c. called by *Tournefort Flore Flosculoso Corymbiferæ Radiatæ*, as *Calendula Bellis Flore Semiflosculoso*; *Papposæ*, as *Hieracium*, *Dens Leonis*, *Tragopogon*, &c. *Non Papposæ*, as *Cichoreum*, *Endivia*, &c.

A *Pappo* or *Down* is a soft Substance, consisting of a great many small *Villi*, or *Hairs*, join'd together, contain'd in the *Head* or *Fruit* of a *Plant*, sometimes separated from the *Seeds*, as in the *Hips* of the *Roses*, and in all the *Capitatæ*, as *Carduus Cyanus*; and sometimes it is adherent to the *Seeds* themselves, as in *Tragopogon*, *Dens Leonis*, for which they may be called *Semina Alata*, to be distinguish'd from the *Semen Barbatum* of the *Carduus Benedictus.*

BOTA-

BOTANICK ESSAYS.

ESSAY III.

Of the different Methods of disposing Plants.

TO distribute or dispose of Plants into a *Method*, is to rank or *Class* them, as Dr. *Morison* justly expresses it, according to their *Cognationes & Affinitates*, i. e. when upon strict Observance of the several Parts of the *Plant*, they find that one, two, or more of their most *essential Parts* agree together in their *Notes* and *Characters*, and that these *Notes* do not vary, but are unchangeable in all Plants rais'd

rais'd from the ſame Seed, or ſprung up from the ſame Root.

Before I attempt to conſider that *Method* it ſelf, and its ſeveral Diſtributions, according to the different Authors, I ſhall firſt ſhew what a *Note* is.

A *Note* is two-fold, either *Characteriſtick* or *Diſtinctive*. A *Characteriſtick Note* is a certain conſtituent part of the *Plant*, which never alters, but is ſo fix'd, that all other Plants which have that part of ſuch a Frame, or ſuch a Figure, ſituated ſo and ſo, and diſpos'd after ſuch a manner, may be juſtly claſs'd together, *v. g.* The *Characteriſtick* of an *Umbelliferous Plant*, is to have a ſmall *Pentapetalous Flower*, to which ſucceed two Seeds firmly united together when green, and eaſily ſeparating from each other when ripe; and all *Plants* (however their *Flower* may be diſpos'd upon the top of the Stalk and Branches, and whatever be the Figure of their *Leaf*) that have theſe Characters of the *Flower* and *Fruit*, are ſtill *Umbelliferous*: For if the Diſpoſition of the *Flower* were requir'd, then the *Tanacetum*, which is a *Corymbiferous Hedera Arborea*, *Sambucus*, *Ebulus*, which are *Bacciferous*, would be *Umbelliferous*, *Plants* alſo, becauſe all of them have ſeveral ſmall *Pedicles* ariſing from them, and ſituated upon the top of the common *Stalk* and *Branches*: *Quadam veluti circinatione Corymbi vel Umbellæ (qua Mulieres*

Mulieres ſolem à Vultu arcere ſolent) adinſtar diſpoſitæ[a]. " diſpos'd in a Circle, mak- " ing the Figure of an *Umbrella*, which Wo- " men carry above their Head to guard their " Faces from the Heat of the Sun, or in a rainy " Day. Neither is it becauſe they have *Folia Lobata*, *Pinnata*, or *Plurifariàm diviſa*, for ſeveral other Plants are ſo too. The *Characteriſtick Note* of a *Planta Spicata & Verticillata* is, that it have either a *Helmet*, or *Lipflower*, and four *Seeds* to ſucceed each of them. *Euphraſia* may be call'd a *Planta Spicata*, by the *Diſpoſition* of the *Flower*, and a *Planta Labiata*, becauſe of its *Figure*; but it cannot be join'd in with the other, becauſe it has a *Capſular Fruit*; *Borrago* and *Bugloſſum* have four *Seeds* to each Flower, but it cannot be join'd with the *Verticillatæ*, becauſe their *Leaves* are diſpos'd in *Pairs*, and the *Leaves* of theſe are *alternately* plac'd. Their *Flowers* have *unequal*, but the *Flowers* of Theſe have *equal*, *Segments*.

A *Diſtinctive Note*, is that by which two Plants, having the ſame *Characteriſtick Notes*, are diſtinguiſh'd from each other, *v. g.* *Meum* and *Fœniculum* agree, in their being *Umbelliferous Plants*, with fine deep cut, dark green Leaves, and a long *ſtriated Seed*; but their diſtinctive *Note* is, that *Fœniculum* grows much higher, has *longer Segments*, *yel-*

[a] Tournef. Inſtitut. R. H. p. 304.

lowiſh

lowiſh Petala, bending upwards; *Meum* has a *perennial*, (moſt of the *Fennels* are annual, or *biennial*) bearded *Root*; *Bupleurum* and *Perfoliata*, have undivided Leaves, in which with the other *Characteriſticks* they agree; but their *Diſtinctive Note* is, that the Stalk *perforates* the *Leaf* of the *Perfoliata*: *Libanotis*, and *Laſerpitium* agree in all their *Characters*, having the ſame *Flower diſpos'd* after the ſame manner, with the ſame *ſemina Rotæ molendinariæ forma*, as Dr. *Moriſon* juſtly compares them. But their *Diſtinctive Note* is, that *Libanotis* has *Folia Lobata*, and *Laſerpitium Folia plurifariàm diviſa*.

Knautius lays down this general Rule for conſtituting the *Characteriſticks* of *Plants*, *viz.* Whatever *Plants* have *Flowers* after the ſame manner, and produce *Seed-Veſſels* conform to the *Flowers*, theſe belong to the ſame *Genus*, and ought to be deſign'd by the ſame *Name*. Thus the *Malva Betonicæ folio* is *a Mallow* by the Flower; but its *Fruit*, conſiſting of ſeveral *capſulæ in capitulum congeſtæ*, according to Dr. *Tournefort*, it is therefore a diſtinct Genus which he calls *Malacoides*; *Alcæa Arboreſcens* has a *Mallow-flower*, but by its having a different *Fruit* divided into ſeveral *Loculamenta* or *Pouches*, is deſervedly a diſtinct Genus, which *Tournefort* calls *Ketmia*.

The

The celebrated Mr. *Ray* lays down the following general Rules for conſtituting a *Method*.

" 1. So few Innovations as poſſible are to " be made. The Names of Plants generally " receiv'd, frequently us'd in the Writings of " Phyſicians, are not to be chang'd but upon " good Grounds, to avoid Confuſion.

" 2. The *Characteriſtick Notes* of the " *principal*, as well as the *ſubaltern Genera*, are to be diſtinct, clearly, and exactly " defin'd, not obſcure and indeterminated, " whoſe Signification is uncertain how far it " may be extended.

" 3. That the *Characteriſtick Notes* be " *manifeſt*, *obvious*, and eaſily *diſcernible*.

" 4. Care is to be taken that the *Congeners*, and theſe in *Affinity* with them, be " not ſeparated; and that Strangers, and ſuch " as do not agree in the Notes, be not introduc'd into the *Family*.

" 5. That no more *Characteriſtick* " *Notes* than what is neceſſary be admitted, " and that no more be requir'd than what is " ſufficient to determinate a *Genus*, leſt the " Memory be over-charg'd, and that inſtead " of *Characteriſtick Notes*, a Diſcription of " the whole *Plant* be given.

Things being thus premis'd, we are to conſider what are the Parts of the Plant which are moſt

most convenient for establishing the *Characteristick Notes*, and how many of them are to be join'd together, in order to constitute a *Genus*.

As to the Parts of the Plants, no doubt the most certain, and such as are least subject to Variation or Changes, are only they which ought to be admitted for *Characteristicks*; and these ought to be the most obvious, and most conducive for the *Preservation* and *Propagation* of the *Species*; Therefore the *Flower* as the most *obvious*, The *Fruit* as most *conducive* for the *Preservation*, and the *Seed* as the Instruments of *Propagating* the Species, are the three, which in my Opinion ought more-especially to be regarded. Not that I would have the *Root* and *Leaf* to be neglected, only they ought to amount to no more than *Distinctive*, but not *Characteristick Notes*. Thus we have *Iris Bulbosâ*, and *Iris Tuberosâ Radice*: They are both *Irides* by the *Flower* and *Fruit*, though they differ in the *Root*. *Rubia*, and its Congeners would be still class'd together by their *Monopetalous Flower*, deeply divided into four *Segments*, and two *succeeding Seeds*, though the Leaves were not dispos'd like the Points of a Star, by which they are called *Stellatæ*; for *Cruciata*, and *Gallium Album*, are as much *Radiate* or *Stellate Plants*, though they have but four Leaves, which proceed from the *Stalk*, as they which have six or eight.

eight. *Conſolida* and *Cynogloſſum*, are as diſtinct from the *verticillate* and *ſpiked* kind, by their *Flowers*, as by their Leaf; and ſhould a Plant be found with the ſame kind of Flower preceding four *Seeds*, it might be join'd in with them, though the Leaves were neither rough, nor alternatively plac'd.

So that I am much of *Tournefort*'s Opinion in that Caſe, that two or three Parts may be join'd together to make up a *Genus*, but no more, whereof the *Flower* and the *Fruit*, or either of theſe join'd with one or two of the other Parts of the Plant, ought to make up the *Character*, v. g. The *Flower-fruit* and *Bulbous Root* can make up the *Iris Bulboſa*, or *Xiphion*, though the Graſs Leaf were wanting; but if a Plant had a *Bulbous Root*, a *Graſs Leaf*, and a *Tricapſular Fruit*, it would not make up a *Xiphion* or *Iris* without the *Flower*, neither could it well be call'd an *Iris*, if it had either a *Pod*, or were *Unicapſular*, though it had the other three *Generical Parts*.

Indeed the *Root* and *Leaf* are very good Auxiliaries, but then they are ſo variable in moſt of the *Genera*, that they can never ſerve to conſtitute the *Claſs* without the aſſiſtance of other more eſſential Parts, *v. g.* A *Bulbous Root* is a very good Mark of *Diſtinction*, and when it meets with an *Hexapetalous*, or *Monapetalous Flower*, divided into ſix *Segments*, as in the *Iris*, *Lillies*, &c. When

too

too it has a *Graſs Leaf*, as the *Allium*, *Cæpa*, *Porrum*, &c. Then with the *Flower Seed*, and *Seed Veſſel*, it may ſerve to make up a *Claſs*, which without them it cannot do; for if we ſhould add all the *Bulbous Roots* together, then ſeveral other *Plants* would be *diſplac'd* from their *Genera*, and after all make up but an uncertain *Claſs*. The *Bulbous rooted Crawfoot* would be a Stranger here, for though it has a Claim to come in by the *Root*, yet becauſe of moſt of its other Parts, it cannot be admitted. *Iris Vulgaris*, *Aſphodelus Paluſtris*, *Arum*, and the *Orchides*, I ſee not how they can be *Affines* or ally'd to the *Bulbous Roots*, when they have not the leaſt Claim to be of Kindred to one another; for there's none of them that has any Pretence to be nearly related to any of the *Bulbous Claſs*, unleſs it be that the *Iris* be of kin to the *Xiphion*. *Aſphodelus Paluſtris* has a Leaf like to the *Iris*, but that's nothing to a *Bulbous Root*; and beſide the *Root* of this *Aſphodelus* is *rather Fibrous* than *Bulbous*, and what Relation has *Arum* to any of theſe; by its Flower it reſembles the *Ariſtolochia*, if any; by its Fruit, it comes in among the *Bacciferæ*, and nothing but its *knotted Root* can bring it in with the *Bulboſis Affines*. The *Flowers* of the *Orchides* vary much, their Fruit reſembles the *Bulbous Claſs* in nothing but having three Holes to ſhed forth its Seeds (if that can be call'd a Reſemblance) for 'tis for the moſt

moſt part *Unicapſular*; and if a *Note* were to be taken from its Root, that would be hidden and not obvious, for you muſt dig them up in ſeveral Species, before it can be known whether it be *Radice Palmatâ*, or *Teſticulatâ*, and if theſe *Bulboſis Affines* were admitted to make a *Claſs* of *Plants*, then they would bring in Diſcord and Confuſion among other *Genera*. How well do all the Species of the *Scrophularia* agree together? But if they ſhall be reſpected according to the *Root*, then there happens a Diviſion in the *Family*; for *Betonica Aquat.* muſt be ſent a packing, becauſe of its *Fibrous Root*, in Contradiction to the other Species of *Scrophularia*, whoſe Roots are *knotted*. Nor can it be receiv'd with any other, for it has but a ſlender Pretence to be join'd with *Betonica*, becauſe of a ſmall Reſemblance in the Leaf, ſo that the *Bulboſis Affines* may be let alone for a *Claſs*.

The *Claſſing* by the *Leaf* is as uncertain. I have already ſhewn how fallible thoſe two Cardinal *Genera*, the *Aſperifoliæ* and *Stellatæ* may prove, and if theſe are ſcarce to be admitted, much leſs any other. Should all theſe who have undivided Leaves be join'd together, what a Confuſion would that make? *Ranunculus Gramineo*, and *Plantaginis Folio* would be ſent off and join'd with the *Plantago aquat. major* and *minor*, which though they be by ſome reckon'd *Ranunculi*, yet they differ from the other, eſpecially

in the *Tripetalous* Flower. *Papaver Hortenſe* would be ſeparated from the *Papaveres Erratici* and *Argemone's*, becauſe it has a whole, and they deeply divided Leaves, and ſo in a great many others. If they are to be claſs'd according to the Diſpoſition of the Leaf, then *Hypericon* might be join'd with the *Plantæ Flore Labiato* of *Tournefort*, becauſe both of them ſend forth their Leaves by Pairs, and ſeveral of the *Umbelliferæ* might be join'd with the *Aſperifoliæ*, becauſe their Leaves are alternatively plac'd, *&c.*

So likewiſe the Diſpoſition of the *Flower* is uncertain. I have ſhewn that its not becauſe ſeveral little *Pentapetalous Flowers* are diſpo'd in a Circle upon the top of the *Stalk* and *Branches*, that a Plant is *Umbelliferous*; for then would *Perfoliata*, *Sanicula*, *Eryngium* be diſ-join'd from the *Umbelliferæ*, and ſo would *Hydrocotyle* of *Tournefort*; but if two Seeds, ſucceeding to each ſmall *Pentapetalous Flower* are to be admitted as *Characteriſtick*, as they are by the common conſent of all Authors, eſpecially if ſeveral of them be join'd in a *Capitulum*, whether with or without Pedicles, then they have the *Flores Circinato diſpoſiti*, and *Pediculis donati*, and the *Folia Lobata*, *Plurifariam* and *Multifariam diviſa*, and *Fœniculacea*, all which were much look'd after in former Times among the *Umbelliferæ*.

Nor

Nor are the *Corymbiferous Plants* a more certain *Claſs*, becauſe of their Diſpoſition *in Corymbum*, like the *Baccæ Hederæ*, for at that rate none would be reckoned a *Corymbiferous Plant*, except *Tanacetum*, *Millefolium*, *Helichryſum*, and ſome others; but when by a *Corymbiferous Plant* is meant a *Floſcular* or *naked Flower*, conſiſting of a great many ſmall *Flouriſhes*, to each of which ſucceeds a *ſolid*, not *pappous Seed*, or a *Radiate Flower*, whoſe *Corona* or *Radius* conſiſts of half *Flouriſhes*, and *Diſcus*, *Umbo*, or *middle part* of the *Flower* has *Flouriſhes*, and a *ſolid*, not *pappous Seed*; then that *Claſs* is determined, whether the *Flowers* are all plac'd upon the top of the *Stalk*, or only proceed from the Spikes of the upper part of the *Stalk*, as *Abſynthium*, *Abrotanum Mas*, *Artemiſia*, &c. 'tis all the ſame. And here the *Diviſion* of the *Leaf* would ſerve to no purpoſe; for I look upon *Balſamita Mas*, call'd by *Caſpar* and *Johannes Bauhinus*, *Mentha Corymbifera*, as a *Tanacetum*, though the one has a *divided*, and the other an *undivided Leaf*, ſince they agree in the *Structure* and *Diſpoſition* of the *Flower* and *Dracunculus hort.* ſive *Trachon. J. B.* to be an *Abrotanum* for the ſame Reaſon. It is difficult to determine wherein the Diſtinction betwixt *Abſynthium*, *Abrotanum* and *Artemiſia* lies, though they are truly diſtinct *Genera*, having the ſame *Flower*, and

dispos'd after the same manner too; and yet Dr. *Tournefort* seems to have been in the right to join the *Trachon* to the *Abrotanum*, rather than to any of the other two.

Mr. *Ray* expresses himself handsomely on this account: "He justly owns, that it's "most difficult to distinguish *Absynthium* "from *Abrotanum*, by certain and proper "Notes, which are competent to all the "*Species Absynthii*, and to none of the *A-* "*brotana*; for 1. It is not the excessive Bit- "terness which is peculiar to several of the "*Absynthia* that will do it; for there is an "*Absynthium insipidum*, and there are seve- "ral of the *Abrotana* that are as much "bitter as the *Absynthia*. It's not, 2. the "*whitish Colour* of the *Leaf*, for there are "some *Abrotana* which have *whitish Leaves*, "as *Abrotanum mas*, *Augusti folium mas*: *B.* "Nor 3. the *woodiness* of the *Stalk*, which "is more peculiar to the *Abrotanum*, for "there are also some *Species* of the *Absyn-* "*thium* which are woody, as *Absynthium* "*Arborescens*, *Lob.* Neither is it 4. the "the *Division* of the *Leaf* into larger and "less *Segments*, for there are Species of "both which have very small *Segments*, "and *finely divided* (though this is not re- "ciprocal, for none of the *Abrotana* have "their *Segments* so large as the *Absynthium* "*vulg. Latif.*) Therefore Mr *Ray* observes, "with Dr. *Tournefort*, that there is some-

"what

" what in the Habit of the Plant (*Gallice* " *Le Port*) by which *Abſynthium*, *Abrota-* " *num*, and *Artemiſia* are diſtinguiſh'd from " each other [b]. *Tournefort* ſays, *Artemi-* " *ſia differt ab Abſynthio ſolâ facie exter-* " *na*; *nam florum diſcrimen oculos pene fugi-* " *unt* [c]. I may likewiſe add, that the *Flo-* *res Penduli*, and *Calix Sphæricus* will not do to all the *Abſynthia*, for *Abſynthium Mari-* *num*, has *erect Flowers*, and an *oblong Ca-* *lix*, like the *Artemiſia*, but there is ſome- what in the *Foliorum Diviſura* which can- not be expreſs'd, and yet by which 'tis eaſy to diſtinguiſh *Artemiſia* from its *Congeners* *Abſynthia* and *Abrotanum mas*. The like is alſo obſervable in the *Adianthum nigrum of-* *ficinarum*, which has ſome unexpreſſible *Di-* *viſions* and *Striæ* in the *Leaf*, by which its diſtinguiſh'd from ſome of the *ſmall Filices* *Saxatiles*, which it otherwiſe very much re- ſembles. *Abrotanum Fœmina*, or *Santolina*, is eaſily diſtinguiſhable from its *Congeners*, if it were but by a *ſingle*, *large Flower*, up- on each *ſingle Stalk*, though Mr. *Ray* brings in Dr. *Tournefort* as uſing the (*Leport*) *Plan-* *tæ habitus*, as a *Note* to *diſtinguiſh* it from the reſt.

Mr. *Ray* brings in the *Corymbiferis Affines* and *Capitatæ*, as two *diſtinct Genera* from the *Corymbiferæ*. I would rather chuſe with

[b] Raii Meth. Emend. p. 37. [c] Turnef. Inſtitut. 460.

Dr. *Tournefort* to bring them all in among the *Flores Floſculoſi*, and then diſtinguiſh them by the *Seminibus Pappoſis* and *non Pappoſis*. For all of them have the *Floſculi Fiſtulares*, though the *Scabioſa* and *Cyanus* differ from the other *Flores Floſculi* in the Figure and *Equality* of their *Segments*.

I'm not very fond of *Lacteſcent* as a *Characteriſtick Note*, to conſtitute a Claſs, for then the *Tithymalls*, *Campanula's*, *Rapuntiums*, &c. might be brought in; and altho' *Pappeſcent* too be added, that's not ſufficient, for then there would be room for the large *Genus* of the *Apocynum's*, which none will pretend to claſs with *Hieracium*, *Dens Leonis*, *Sonchus*, &c. So that I think Dr. *Tournefort* was in the right for joining all the *Flores Semifloſculoſi* or *Flowers* with *half Flouriſhes* together, and then he had a good Opportunity to diſtinguiſh betwixt thoſe which had *Semina Pappoſa* and *non Pappoſa*, for that of *Flore Compoſito* is too general, and capable of too many *Sub-diviſions* to render the Method of diſtributing Plants ſuccinct and eaſy to be underſtood.

To ſum up what has been already ſaid concerning the manner of diſtributing *Plants* according to their ſeveral *Genera* and *Species*, by their *Characteriſtick* and *Diſtinctive Notes*. As there is a Neceſſity of joining two, three, or perhaps more of theſe *Notes* together, to render the *Plants* the more intelligible

telligible, and make the Knowledge of them be the more easily acquir'd, so it is most difficult to be determinate which of them are fittest to be receiv'd as *Characteristicks*, and which as *Distinctive*; for in treating of *Plants* now-a-days, *Authors* are not to chuse the easiest *Method* for themselves, in order to make the Description of one Plant follow another, as some do it *Alphabetically*, that they may not be render'd uneasy in assigning to each *Genus* the *Characteristick*, and each *Species* its *Distinctive Note*. Others according to the Seasons of the Year, that they may describe the first *Plant* that comes to hand without Distinction, as *Besserus* did when he gave those elegant Figures of *Plants* in the *Hortus Eystitensis*, or according to their Virtues, that they may heap up confusedly together, those that are good for such and such a Distemper, whether they be so or not; as *Parkinson* in his *Paradisus Terrestris*, and *Theatrum Botanicum*; or according to the *Facies Externa*, and *Plantæ Habitus*, as *Mathiolus* in his *Commentaries* upon *Dioscorides*. But Authors are now to chuse the most intelligible *Method* to teach others (and not to please themselves) by laying down some of the principal Parts of the *Plant* as *Characteristick Notes*, and then *dividing* and *sub-dividing* all those which partake of such and such a *Characteristick*, into their several *Genera* and *Species*, according to these call'd *Distinctive*

Notes, v. g. If the *Flower* be *Characteriſtick*, then the *Fruit* or *Seed-Veſſel* and *Seed* muſt conſtitute the *Genus*, and the other leſs material Parts, ſuch as the *Root*, *Stalk* and *Leaf*, muſt be conſidered, in order to make up the ſeveral *Species* belonging to ſuch a *Genus*. If the *Fruit* or *Seed*, and *Seed-Veſſel*, be the *Characteriſtick*, then the *Flower* and other Parts muſt be had Recourſe to for Diſtinctions ſake; and if the *Root* and *Leaf* be look'd upon as ſuch, then the other Parts of the *Plant* muſt be ſubſervient to them.

And herein it is that the great Conteſt among Authors lies, what Number of Parts, and which of them ſhall be look'd upon as *Characteriſtick*, &c. every one joining one or more of them together, as their Humours and Fancies lead them, by which they have multiply'd *Methods* ſo faſt in a ſhort Time, that if *Botanick* Writers go on at this rate, e'er it be long they ſhall render *Plants* as unintelligible by *Method*, becauſe of their great Plurality, as formerly it was to know the *Plants* without *Method*. But would *Authors* from henceforth obſerve the following Rules, I perſuade my ſelf ſuch vaſt Inconveniencies would be prevented, and that delightful Science of *Botany* would be farther advanc'd. The *Students* of it would not be ſo much diſcourag'd, and others might be perſuaded to betake themſelves to that laudable Study, which

carries

carries so much Innocence and Simplicity along with it, which yields so much Pleasure and Satisfaction to those who pry into it, and which affords Matter of so much curious Speculation, that it's pity any such Obstruction should be made to its Progress, by the Mismanagement of those who ought rather to be instrumental in its Propagation.

1. Then it were convenient, that all the Writers upon that Subject would cease to treat one another undecently, by reflecting upon their Knowledge, or accusing them of Unskilfulness, (because they have fail'd in their Observation, and have not come up to that Nicety in describing of a Plant as another) which only serve to raise Disputes, and be a Means of Altercation and Strife, rather than of searching after the Truth.

2. Since 'tis acknowledg'd by all, that the *Flower*, *Fruit*, *Seed* and *Seed Vessel*, are the most essential Parts of the *Plant*; and that there are *Methods* enough already establish'd, into which *Plants* have been dispos'd according to their *Characteristick Notes*; it were convenient that none would give themselves the trouble, or rack their Brains, to find out any new *Method*, wherein to dispose of Plants, different from what has been laid down: But by being sedulous in making of new Observations, that they would impartially correct and amend what they find amiss in the former *Methods*, by altering the *Titles*

where

where they find a *Diſcrepancy*, adding to the *Characteriſticks* where there is a real *Deficiency*, and ſometimes tranſpoſing of *Plants* when they find them miſplac'd; but ſtill with a due Deference to the Founder, who ſhould always have the Honour of the Name of the *Method*, becauſe he was at ſo great Pains to claſs them firſt together in ſuch a manner; *v. g.* Mr. *Ray* once claſs'd *Arum* among the *Bulboſis Affines* [d], as has been obſerv'd; after that he more juſtly join'd it to the *Bacciferæ* [e]; but ſince he has plac'd it among the *Fructu magis ſparſo*, it were convenient to remove it from thence, and with its *Congeners*, *Dracontium*, *Ariſarum* and *Colocaſia*, make up a new Title, *viz. Bacciferæ Fructu Aggregato ſive Coacervato*, in contra-diſtinction to the former. Now this may be done without any Prejudice to the *Method*, and yet be of more uſe to the Reader; for tho' in the *particular Note* of *Arum*, it is ſaid to have *Fructum è baccis Coacervatis*, yet ſince this is contradictory to the Title, 'tis convenient that ſuch be rectify'd, becauſe Readers often rely upon what is contain'd in the *Title*, without being at pains to examine the *Notes* belonging to each particular *Genus*, and ſo may be led into a Miſtake: So that whether the Deſign of the *Method* be to claſs

[d] Synopſ. Stirp. Brit. p. 234, 235. & Auct. p. 75.

[e] Meth. Emend.

the

the Plants by the *Flower*, and distinguish them by the *Fruit*, or to class them by the *Fruit*, and distinguish them by the *Flower*, there may be still work enough for the curious *Botanist* to alter the *Titles* of the *Genera* themselves, rectify the *subaltern Genera*, and render the *Characters* of any particular *Plant* more obvious, without prejudice to the *Method* it self, by pulling it down, that another may be built upon its Ruins, or doing what may reflect upon its Author, which I am sorry should be so frequently done.

3. That special Care be had not to invent new Terms of Art, establish new *Genera*, nor deprive any *Plant* of a long-receiv'd Name, upon any trivial Pretence; but what needs must, in order to rectify gross Mistakes: For the unnecessary *Multiplication* of these, is ready to create a Confusion, and puzzle the *Botanick Student*, upon every slight Occasion.

Therefore all Endeavours should be us'd, to find out a proper *Genus*, already established, to which such and such a Plant may be referr'd, and with which it may agree in the Character: And I'm convinc'd, if this were rightly observ'd, there would not be so many *Plantæ sui generis* or *incertæ sedis*, nor so many *anomalous* Plants, as are frequently pointed out to us by Authors.

Having thus premis'd what I thought convenient, to make it be understood what is meant

meant by *Method*, I ſhall next proceeed to give an account of the Origine and Progreſs of it.

I have already ſhewn what might have been the Ground-work upon which Dr. *Moriſon* built his Method, and what might have been the Means of ſetting him to work, in correcting the Errors of others, and in eſtabliſhing a new one of his own; which has been a Pattern to all thoſe who have writ upon Method ever ſince. And I'm ſorry to find ſome, otherwiſe good, learned, and ingenious Perſons, at ſo much pains, to calumniate, inveigh againſt, and detract from that great Man, thoſe due Praiſes he juſtly deſerves; as being the chief Author, I may juſtly ſay Founder of ſo great an Undertaking, as that of the diſpoſing of Plants into a *Method*; and to reflect ſo much upon his Memory after he was dead, and not able to anſwer for himſelf.

I'm likewiſe much concern'd, that one who by his unfortunate and untimely Death, (which happen'd *non ſine inſigni Rei Herbariæ jacturâ*, as *Ammannus* juſtly expreſſes it [f]) has arriv'd at the higheſt Pitch of *Honour* and *Glory*, by the Improvements he made, and *Correſpondence* he has kept with the greateſt *Botaniſts* in *Europe* ever ſince, ſhould not have reſted contented with the *Spolia* of his *Com-*

[f] Amman. Charact. Plant. Genuina. Præf. p. 10.

petitor,

petitor, but throughout the whole Course of his Life, and even when it may be said, that one of his Feet were in the Grave, and the other following, according to the Proverb, continu'd to rake into his Ashes, and to commemorate his Imperfections (which in a Christian way ought to have been buried in oblivion) after a most barbarous, undecent and inhumane Manner; as is to be seen in the Margin, and which will not bear a Translation [g]; and all this because *Cæsarve priorem Pompeiusve parem.*

Dr. *Morison* had spent a great deal of his Time in observing of the Plants themselves: by the Encouragement of the *Duke* of *Orleance*, his *Patron*, had bestow'd much Mony in procuring a great many foreign and rare Plants; did by indefatigable Pains, Industry and Labour, traverse, search after and obtain, from all the Parts of *France*, such a Quantity

Morison's *Method.*

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g Hac re graviter offensus D. Robertus Morisonus Aberdonensis Scotus M. D. veritus fortasse ne quid famæ suæ & auctoritati (quem non mediocrem inter Botanicos nec immeritò sibi comparaverat) editis speciminibus methodi illius quam se non libris hausisse sed à natura ipsa edoctum fuisse *gloriabatur*, decederet; meque in messem suam falcem immittere ægrè ferens, tabulas illas tacito auctoris nomine indignis modis laceravit. Ego quamvis methodum illam reprehensioni obnoxiam, nec tantùm imperfectam sed in multis vitiosam fuisse agnoscerem, cum tamen viderim me *ab homine αὐθάδει suique pleno ne quid durius dicam aut manes ejus inquietem, contemptum & ludibrio planè habitum*, ut existimationi meæ aliquatenus consulerem, tentare statui quod naturæ ductum in plantis digerendis & methodo instituendâ possem. Præf. ad Meth. Emend.

of

of *indigenous* Plants, as to make up a large Catalogue in five Years time, of which there were 260 *non Descripts*. He was also indefatigable in turning over and consulting of ancient Authors, thereby finding out what made for his Purpose, and detecting of their Errors, by which he compos'd those notable *Hallucinationes*, now so much decry'd and enveigh'd against, because of the unusual Title, *Hallucinatio*; though that now so much despis'd Treatise, was the first which gave so much Insight to those who afterwards gain'd so much Fame, and who notwithstanding of what they obtain'd by it, did ever continue in a ridiculous manner to speak against it. Dr. *Morison*, I say, as the effect of so much Labour, did first receive the fore-mentioned Hints from the above-nam'd *Gesner*, *Columna* and *Cæsalpinus*; and by distributing of the Plants, not only according to these Hints, but according to his own repeated Observations, *reviv'd*, *restor'd*, and I may justly say *founded*, that which is called *Method*. And because he justly assumes the Glory of so great a Work to himself, he is revil'd, despis'd, call'd proud, vainglorious, ostentatious [h], *&c.* and even by those who were much more profited by him, than he was by *Gesner* and *Columna*, so of-

[h] Verùm cùm sibi nimis placeret & alios se doctiores contemneret, majora viribus aggredi & plantarum historiam universalem conscribere ausus, nec famæ suæ consuluit nec aliorum expectationi satisfecit. Præf. ad Hist.

ten thrown in his Face, and so much made use of as a Handle against his Memory; but any impartial Person, who will but take notice of his own Words, and read him in his own Language, will, I'm perswaded, be ready to have a quite different Impression from what is industriously spread against him.

In the Dedication of the *Hortus Blesensis*, to King *Charles* II. he says, "[i] That the "Method is now given by Nature, and by "him alone (without Vanity) only observ'd, "discovered by none but himself, although "it be of an equal Date with the begin-"ning of the World." This is the Expression which makes all the Noise; and yet if it be look'd to by an impartial Eye, it is not so liable to Exception as others would have it: For let it be own'd, that he built upon the Foundation of others, yet by his correcting of their Errors, clearing up of their Obscurities, and making the whole so plain and obvious, by considerable, not imaginary Alterations, *ex autopsia*, from the exact Observation of the *Plants* themselves; and if the several Distributions of the *Plants*, according to the Foundation, be his own, without the Help and Assistance of any other, may not he justly have call'd all this his own do-

[i] Quin & methodum meam novam à natura datam à me solummodo (citra jactantiam) observatam à nullo nisi meipso in hunc usque detectam quamvis mundi incunabilis sit coæva. Hort. Blef. Epist. Dedicat. ad Car. Reg. 2.

ings;

ings; and is there any juſt Reaſon of reflecting againſt him for ſo ſaying? But hear him farther, as to what he propoſes for a Recompence to his Pains; and how prophetical he has prov'd in what he propos'd; "I perſuade "my ſelf, ſays he, that your Iſland of *Britain* (ſpeaking to King *Charles*) ſhall hereafter have as good reaſon to glory in the "Knowledge of Plants by a moſt exact *Method*, which is that of Nature it ſelf, as the "*Germans*, *French* and *Italians*, were famous for their Knowledge of the *Botany* "without a *Method* in the former Age[k]." And what a vaſt Progreſs the Knowledge of *Botany* has ſince made in the Iſland of *Britain*, by the Means of *Method*, to which he gave the firſt Example, very well appears at this Day.

The ſecond Part of the Calumny rais'd againſt him was promoted by a Foreigner[l], *viz.* that in his *Hallucinationes* he had reflected upon the Authority of ſo great an Author as *Caſpar Bauhinus*; as if Error ſhould ſtill be allow'd to continue, and not be ſpoke againſt, becauſe of the great Value and

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[k] Polliceor Britanniam veſtram cum methodo exactiſſimâ quæ eſt naturæ ipſius impoſterum in re Botanicâ gloriari poſſe; quemadmodum Italia, Gallia, Germania, ſuperiori ſeculo in ſcientia Botanica ſine methodo gloriati ſunt.

[l] Nullam itaque video querelæ cauſſam quam Konigius de Regno vegetabili, p. 34. adducit contra Moriſonum; quod in Hallucinationibus ſuis autoritatem tanti viri Bauhini elevarit. Charact. Plant. Genuin. Ammanni. p. 13.

Eſteem

Eſteem of thoſe who firſt advanc'd it. But ſee what he himſelf ſays upon that Subject; "I "would not have you, friendly Reader, ſays "he, to look upon me as a vainglorious and "inſolent Writer, becauſe I do not only cor-"rect the Errors of thoſe of this Age, but "the chief of all the *Botaniſts* that ever liv'd; "I mean the celebrated Brethren *John* and "*Caſpar Bauhinus*. By the frequent Inſpe-"ction, and by a long and continued Ex-"amination of their Volumes, I find them "to have been Perſons of great Judg-"ment, indefatigable Pains, and incompara-"ble Knowledge in the *Botany*; and I do "declare, that, whether by Fate or a natu-"ral Propenſity, they had a great Deſire to "promote and encourage all the Students in "that Science; but that both have frequent-"ly err'd, any Perſon, who has but a mo-"derate Knowledge in the *Botany*, will ſoon "obſerve, by the reading of this ſmall Trea-"tiſe: Nevertheleſs, I confeſs that to err is "a human Failing. I am a Man my ſelf, "nothing is to be expected from me but "what is human. I doubt not but I have "alſo err'd *(hallucinatus)* in theſe ſmall "Treatiſes; therefore I deſire to be forgiven "by thee for theſe my *Hallucinationes* or "Errors[m]." This, one would think, is mo-

G deſt

[m] Noli quæſo amice lector me glorioſum aut inſolentem exiſtimare Scriptorem, quód non ſolùm hujus ſæculi ſed omnium

deſt and condeſcending enough, attributing due Praiſes to his Predeceſſors, without aſſuming too much Glory to himſelf: Yet *Nebelius*, the Annotator upon *Ammannus*, will not let him go ſo, but being prepoſſeſs'd with what others had advanc'd to his Prejudice, puts a ſiniſter Conſtruction upon this, contrary to what he deſires; and alluding to this Paſſage, he inſiſts, "The Difficulty and Extenſiveneſs "of the Study of *Botany*, may eaſily excuſe "the raſh and unpremeditated Errors of that "moſt deſerving *Botaniſt*, *Caſpar Bauhinus*, "according to *Moriſon*'s own Acknowledg- "ment, (*Loco Citato*,) in naming and diſtri- "buting of the Vegetables; which whether "*Moriſon* himſelf committed the like, when "he too confidently and boldly did dare to "aſſert, that the Method of diſtinguiſhing "the Plants by the Fructification, was only "diſcovered by himſelf, when he does not "mention, among the Authors cited for wit- "neſs, *Cæſalpinus* and *Columna*, who former-

nium qui adhuc extitere, Botanicorum coryphæos duos Caſparum & Joannem Bauhinum fratres corrigo. Ex frequenti enim ipſorum voluminum inſpectione & ex longa & diutina eorundem examinatione ipſos ſummi judicii, indefeſſi laboris & incomparabilis doctrinæ in ſcientia Botanica homines fuiſſe obſervo; ipſosque ſeu fato ſeu naturali propenſione maximum in promovendis ſtudiis Botanicorum habuiſſe deſiderium: pariter declaro erráſſe multoties utrumque; nemo in Re Botanica mediocriter verſatus inficias ibit. Hos meos tractatulos legendo labi nihilominus humanum eſſe confiteor; homo ſum ipſe, humani à me nihil alienum puto; in hiſce meis tractatulis hallucinatum me eſſe non dubito. Quapropter hallucinationes meas ab amico lectore notari deſidero. Præf. ad Halluc. Bauhin.

" ly commended and design'd this Method, I " leave it to the Judgment of others[n]." The *Matchiavillian* Principle here holds good, *Calumniare audacter & semper aliquid adhærebit.* I would ask that Writer, whether commending and designing a Method be putting it in practice, by distributing of Plants according to it? But his being prejudic'd against Dr. *Morison* by the Instigation of others farther appears; for after he had ascrib'd to him that due Praise which none yet had the boldness to refuse, he says, " That he " could not escape the just Censure of *John* " *Ray* and *Pitton Tournefort*, for publishing " the Thoughts of others as his own Inven- " tion, and never known to any before.

It is these and the like Expressions, us'd by Foreigners, that oblige me to insist longer upon the Character of Dr. *Morison*, and to search the Ground of all this Prejudice to the Bottom: But before I do that, I shall produce several Testimonies of more impartial Authors, and even of those piqu'd against him,

[n] Studii Botanici difficultas & amplitudo excusare facile potest Caspari Bauhini viri in re Botanica (ipso Morisono in præfat. hallucin. teste) optime meriti improvisos in denominandis digerendisque vegetabilibus errores; quales an etiam Morison commiserit dum suam plantas à fructificatione dignoscere methodum à se solo detectam neminique prius cognitam audacter nimis asserit & tamen inter auctores ad testimonium citatos suis, Cæsalpini atque Columnæ qui eandem methodum pridem commendarunt & designarunt, mentionem fecit, aliis dijudicandum relinquo. Nebel. Annot. in Amman. p. 13, 31.

thereby to ſhew the Value of that great Man; and to ſhew how far he is to be look'd upon as the Author and Founder of Method. I ſhall begin with the fore-cited *Ammannus*.

" In the mean time, ſays he, by very good " Fortune did the Town of *Aberdeen* in *Scot-* " *land* bring forth *Robert Moriſon*, by whoſe " Favour and inexpreſſible Diligence, the *Bo-* " *tany* of the Ancients is recovered, and has " now put on a quite different Countenance, " as may be ſeen by any unbiaſs'd Perſon, " who is not blinded with Prejudice in the " *Hallucinationes*, which he ſo abundantly " produc'd againſt the *Methods* of the Anci- " ents, in his *Hortus Bleſenſis*, and *Hiſtoria* " *Oxonienſis*; inſomuch, that (without pre- " judice to our Anceſtors) I am not aſham'd " to ſay, there appears more Candour, " more Truth, in theſe his nervous Works; " and that there is contain'd in them, more " to the Benefit and Advantage of the Pro- " feſſors, than in the moſt numerous Volumes " of ancient Writings; and being oblig'd to " declare it out of Conſcience, rather than " from any Love and Affection I may have " to the ſeveral Parts of that Study, I doubt " not but this Affair might have been brought " to the utmoſt Pitch of Perfection, by the " Publication of the other XXIV *Sections* " which would have compleated the whole " *Hiſtory* of *Oxford*, had it not pleas'd Al-

" mighty God to have disposd of that " great *Botanist* otherwise [o]". The same ingenious Author says further [p], " That *Cæ-* " *salpinus Castellus*, and *Fabius Columna* " had thought upon this Method, as appears " by what is here and there scatter'd among " their Writings; but I know not what Stops

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o Interea Aberdunum in Scotia felici admodum omine protulit *Robertum Morisonum*, cujus auspiciis atque ineffabili solertia Botanica veterum delarvata atque aliam longe faciem nunc induit, veluti videri est cuilibet præconceptis opinionibus non obcæcato ex Hallucinationibus quas in horto Blesensi & historia Oxonienſi, luculenter adduxit, contra methodum antiquorum; adeo ut citra tamen injuriam antecessorum dicere non erubescamus, in nervosis hisce operibus plus nitoris plus veritatis atque plus commodi ad philiatros spectantis contineri, quàm in numerosissimis voluminibus omnium quæ sapit veterum prosapiam. Conscientia cujusvis extra partium studia atque affectus positi, sit arbitra. Nec dubitandum quin ad supremum perfectionis apicem negotium hoc fuisset deductum editione restantium viginti quatuor sectionum quibus historia Oxonienſis tota compleri debebat, nisi deo cujus erat γεώργιον de hoc insigni Botanico aliter visum fuisset. Amman. Præfat. ad Charact. Plant.

p Meditatos hoc fuisse ingeniosissimos Cæsalpinum Castelum & Fab. Columnam hinc inde ex scriptis illorum liquet. & nescio quid moræ interea interjectum fuerit quo minus hucusque negotium istud potuerit perfici. instet aliquis, alii præter hos munere istoc functi sunt peculiare, methodum Botanicam adornandi. Audio hæc sed non memini me ullum autorem legere qui attendisset legem naturæ, id est quæ genera & species plantarum per notas essentiales, quæ semper & omni insunt, sumendo differentias à fine ultimo sciz. à fructificatione; non inqua mmemini ullius: Citra tamen supercilium & arrogantiam utpote qui per multos annos hoc unice egi solus. At ipse *Morisonus* glaciem hanc fregit hyperboream in Hallucinationibus quas contra Bauhinos tam in histor. Oxonienſi quam hort. Blesi. publici juris fecit. Amman. Charact. p. 3.—

" and Delays interven'd, which all along " hinder'd that Affair from being brought to " Perfection; let any Perſon produce ano- " ther (beſide theſe) who did that Work, who " by a peculiar *Method* had adorn'd the *Bo-* " *tany*. I have heard of theſe Things, but " do not remember that I have read of any " *Author* who has ſo obſerv'd the *Method* " of *Nature*, that is, which diſtributes the " *Genera* and *Species* of *Plants* by the *eſ-* " *ſential Notes*, which are in every one ta- " king their Diſtinction from the *Ultimate* " *End*, which is the *Fructification*. I do " not remember, ſays he, any who with- " out Vanity or Arrogancy has done ſo as I " have done for many Years. But it was " *Moriſon* himſelf who broke this tough Ice " in his *Hallucinationes* againſt the two " *Bauhini*'s, both in his *Hortus Bleſenſis*, " and *Hiſtoria Oxonienſis*". But his Anno- tator will not let it go ſo, he tells you, " That *Conradus Geſnerus* had thought of " that Method 130 Years agoe, *&c.* when " he wrote to his Friends, that the Nature " and Kindred of the Plants was to be taken " from the Fruit, or rather Flower and Seed, " than from their Leaves [q]."

That this was *Geſner*'s Opinion, is own'd by the conſent of ſeveral Authors, as alſo by

[q] Hiſque priorem C. Geſnerum qui ante plus centum & triginta annos in ſuis epiſtolis ad amicos ſcripſit ex fructu ſemine ac flore potius quam folio, ſtirpium naturas & cognationes apparere. Nebel. Annot. in Amman. p. 4.

ſome

ſome Fragments of his Epiſtles yet extant; but then this Opinion was only ſcattered here and there, as *Ammannus* ſays of *Cæſalpinus*, without any Improvement made of it, or any *Method* brought to Perfection by it: Nor was it ſo long before *Cæſalpinus* and *Columna*'s Time, for *Geſner* was Cotemporary with them. He wrote his Eiſtles, *Anno* 1564, and dy'd in 1565. *Cæſalpinus* 1562, and *Columna* much about the ſame time; for his Works were poſthumous, being publiſh'd after his Death by *Hieronymus Columna* 1592, and afterwards 1606, by all which it appears, that the three wrote much about the ſame Time; and if *Geſner* did any thing upon that Subject, moſt of them periſh'd by the Careleſneſs of *Wolphius*'s and *Camerarius*, as the ingenious *Tournefort* teſtifies; ſo that whatever any of them advanc'd upon that Head, whatever *Nebelius* or his Abettors, or rather Inſtructors, could ſay to the contrary, the bringing of Method to any degree of Perfection, is intirely owing to the great Dr. *Moriſon*, which will further appear by the Teſtimonies of other unbyaſs'd Foreigners, and even from the Writings of ſuch as have expreſs'd ſo much Enmity againſt him.

Dr. *Knaut*, in his *Methodus Plantarum Genuina*, teſtifies thus: "But when the *celebrated Moriſon*, obſerved that all theſe "*Methods* were carry'd on by mere Acci- "dents, that they were inſtable and falli-

" ble, and as the Philosophers say, no ways " Scientifick, therefore he neglected, and " threw them off, substituting, or rather " restoring more *essential Characters* or *Distinctive Notes* of *Plants*, which cannot " deceive [r]; and again, having shew'd how " uneasy it was for *Caspar Bauhinus* to understand *Cæsalpinus* his *Method*: So much " the more Praise is due, says he, to the *Celebrated Morison*, who having overcome " the Difficulties that stood in his way, recovered his praise-worthy *Method*, and re" stor'd it from Darkness to Light", according to that notable Character given him by the *Celebrated* Dr. *Tournefort* [s].

" The true Method of constituting the " *Genera* of *Plants*, may be attributed to " *Gesner* and *Columna*; but it's probable " that had yet lain in Darkness, had not " *Robert Morison*, a *Scotch* Man, of *Aber*" *deen*, who was for several Years Overseer " of the Gardens belonging to that High and " Mighty Prince, *Gaston*, Duke of *Orle*" *ans*, renew'd, restor'd, and first of all ac-

[r] Cùm enim Clarus Morisonus *in prælud. Botan. hist. Oxon. & sect. de umbellif.* animadverteret per mera accidentia procedere omnes istas methodos, instabiles adeo ac fallaces necquod philosophi aiunt scientificas; neglectis iis resectisque, essentiales potius characteres seu notas plantarum distinctivas, à fructificatione fallere nescià desumptas, substituit aut verius restituit. Knaut. Differt. Prælim. de Meth. Plant. p. 3.

[s] Tanto majori laudi datur *Cl. Morisono*, quòd superatis quæ obstare videbantur difficultatibus methodum laudatam, velut è tenebris in lucem retraxit. Ibid. p. 5.

" commodated

" commodated it for daily Uſe, for which " he's highly to be prais'd, and he would " have yet deſerv'd much more, if he had not " been too much puff'd up [t]". Thanks be to Mr. *Ray* for this laſt part of the Character, 'tis from his Inſinuations that all theſe bad Impreſſions have proceeded, as is too evident, notwithſtanding which he is forc'd to acknowledge his other Perfections in *Botanick* Matters.

" So long as he (*Robert Moriſon* a *Scotch* " Man, of *Aberdeen*) kept himſelf within " his own Bounds, or mov'd within his " own Sphere, by compoſing the Catalogues " of Gardens, finding out the *Characteri-* " *ſtick Notes* of the *Genera*, diſcovering and " correcting the Errors, or as he is pleas'd " to call them, *Hallucinations* of *Botaniſts* " in the Diſpoſition of the Species, he de- " ſerv'd very much to be prais'd; but when " he became too full of himſelf [u] — I wiſh Mr. *Ray* had let this laſt part of Dr. *Moriſon*'s

[t] Legitima igitur conſtituendorum Generum ratio Geſnero & Columnæ tribui debet, eaque forte in tenebris adhuc jaceret niſi *Robertus Moriſonus*, *Scotus Aberdonenſis*, qui per plures annos præfuit Hortis ſereniſſimi principis Gaſtonis, Aurelianenſium ducis, eam quaſi ab herbariis abalienatam renovaſſet, inſtauraſſet, & primus ad uſus quotidianos adjunxiſſet: qua in re ſummis laudibus excipiendus, longe vero majoribus ſi à ſuis abſtinuiſſet.

[u] Hic quamdiu intra limites ſuos ſe continuit & catalogis Hortorum componendis notis Generum characteriſticis indagandis Botanicorum, in diſpoſitione ſpecierum, erroribus aut ut loqui amat, Hallucinationibus detegendis, corrigendiſque operam dedit, laudem ſane meruit. Verum cum &c. Raii Hiſt.

Character,

Character, already cited*, alone, for *Turpe eſt Doctori, cùm Culpa redarguat ipſum.* There is not one Word in all that ſecond Part, but a malevolent Pen might apply, ſo as to make it retort upon Mr. *Ray* himſelf. So true it is, that *Carere debet vitio qui in alterum paratus eſt dicere.* But I forbear, leaſt I ſhould be ſaid to reflect as much upon Mr. *Ray*, as he has done againſt Dr. *Moriſon*; and ſhall only add what Account I have receiv'd from thoſe who were intimately acquainted with Dr. *Moriſon, viz.* That he was a plain, down-right, honeſt Man; no Flatterer nor Diſſembler, but who would tell the naked Truth upon all Occaſions, *Fuit vir qui ficum ficum vocavit*, ſays the Author of his Life. As he loved *Botany* himſelf, ſo he was a ſincere, hearty Lover and Encourager of *Botaniſts*; his Fame was ſo far eſtabliſh'd before he came to *England*, that he had no reaſon to be afraid that Mr. *Ray*'s Appearance would darken his Light; but the Truth is, he had already eſtabliſh'd a *Method*, ſuch as he was of Opinion was ſufficient for the Improvement of *Botany*. The Opportunities he had of obſerving *Plants* enabled him and render'd him ſtill the more capable to correct what he might have done amiſs in his firſt Volume, and alter the Diſpoſitions as he had a mind, in what he was to publiſh in the other Volumes; ſo that he had Reaſon to be angry with any other, who

* P. 78. Litera h.

not

not having the same Opportunities of becoming *Botanists*, would attempt to establish any other Method than he had done. Mr. *Ray* on the other hand, had by this Time acquir'd a moderate Skill in *Botany*, and had he apply'd himself to, and kept a Correspondence with Dr. *Morison*, who was in such a Station as it was no disparagement for him to do so, then they might have compar'd their Thoughts, and communicated to each other what they found convenient for the Advancement of that Science, by one and the same Method, without endeavouring to multiply *Methods*, so as to confound the Learners; but when instead of that Mr. *Ray* would needs set up for a Method of his own, in Opposition to the other, Dr. *Morison*, or any other in his Station, had reason enough to be angry with him for it; for Mr. *Ray* labour'd under so many Inconveniencies when he compos'd it; the many Errors with which it abounded when compos'd, and the Assistance he had from Dr. *Morison*'s Writings, (all which Mr. *Ray* acknowledges fully himself) were such as I am afraid will render Mr. *Ray* the ostentatious and vain-glorious Person, and shew how fond he was to be Dr. *Morison*'s *Rival*, and how little capable he was of being it. So that as Dr. *Morison* had reason to be angry with Mr. *Ray*, it was a great Failing in Mr. *Ray* to have such a Resentment against Dr. *Morison*'s Memory, since 'twas Mr. *Ray* who first gave the ground of Offence.

But

But leaving this, and to shew how impartial I am, I shall produce several Instances to prove, that Dr. *Morison*'s *Method* in his Second Volume, is not so perfect, but that it needs several Amendments, which had he liv'd, perhaps he had corrected himself; for as none in his Time understood better how to make Observations upon *Plants* than he did, so the Escapes in his *Method* seem to have proceeded purely from Inadvertency, and not from Ignorance.

[x] Dr. *Knaut* very justly remarks, "That "he is not every where consistent, nor ob- "serves the *Method* he had propos'd with "the same Constancy; but whereas he ought "always to have taken the Notes of the *Sub-* "*altern Genera*, from the *Fructification* "only, sometimes he takes them from the "*Leaf*, sometimes from the *Stalk*, from the "*Climbers*, *Capreoli*, and *Roots*; but for "these he is rather to be blam'd for Incon- "stancy than for any inexplicable Obscurity". This is a just Character of his *Method*, and in this he is excusable so far, in that when he compos'd it, he was to do all of himself; not one of his Contemporaries so much as dream'd of *Method* before he did it; he had none to

x Hoc uno forte culpandus (*Morisonus*) quod iisdem methodi vestigiis non ubique pari constantiâ insistit, sed quas à fructificatione petere undequaque debebat generis subalterni notas, à foliis, alicubi caulibus, item capreolis, atque radicibus desumserit; inconstantiæ potius quam obscuritatis inexplicabilis coarguendus. Knaut. Meth. Plan. genuin. p. 4.

correspond

correſpond or conſult with concerning it; in the which he laboured under far greater Inconveniencies, than any who have writ upon Method ſince, who had nothing to do but obſerve his Steps, and correct his Eſcapes rather than Errors, in order to make up a compleat Method; for I find he fail'd chiefly in making of his *Sections* too large; ſo that after he has done with what more particularly belong'd to ſuch a *Section*, there are ſome Incoherencies in ſeveral Chapters of the *Subaltern Genera*, *v. g.* In the *Sect. de Umbellif.* which was the Specimen of all the reſt, and therefore firſt publiſhed. After he has done with thoſe, by the common Conſent of all reckoned *Umbelliferous Plants*, he ſubjoins the *Umbelliferæ impropriè dictæ*, ſuch as *Valeriana*, *Valerianella*, *Valeriana Græca*, by *Tournefort* call'd *Polemonium*, *Pimpinella Sanguiſorba*, *Thalictrum*, *Filipendula*, *Ulmaria*; none of which can be claſs'd with the *Umbelliferæ*, except by ſome Reſemblance in the Diſpoſition of the *Flower*, which is competent to other Plants beſide them.

In the firſt *Section* he places *Chriſtophoriana* next *Aſparagus*, becauſe its Berries are *Racematim diſpoſitæ*, Chap. 2. the *Campanulatæ Lacteſcentes*, ſuch as *Convolvulus Scamonia dictus*, &c. betwixt the *Bacciferæ* and *Pomiferæ Scandentes*, though both of them have a *pulpous* and *parenchymatous*, and theſe *Campanulatæ*

panulatæ have a dry *membranaceous Fruit*; by which they ſhould rather have been plac'd after them, or join'd with the other *Convolvuli*. *Convolvulus Heteroclitus ſive Lupulus*, is *Heteroclitus* indeed in this Place; for there is nothing can bring it in here, unleſs it be an infirm Stalk, which requires a Pole to ſupport it.

Sect. 2. The firſt fourteen Chapters of this *Section* are acknowledg'd to belong to the *Leguminous Plants* by all Authors; but then the *Trifol. Acetoſ.* in the 15. *Frag. Veſca* in the 16. the *Pentaphyllæ* and *Pentaphylloid* in the 17. and *Pentaphyllis Affines*, as *Alchymilli*, in the 18, ought to be disjoin'd, and plac'd elſewhere.

Sect. 3. *Tetrapetalæ Siliquoſæ Bicapſ.* are very regular for the firſt 10 Chapters; and the *Chelidonium majus* in the 11. may not be unfitly join'd with them, provided the *Glaucium* or *Papaver Corniculatum* be join'd with it; for they ſhould always go together, notwithſtanding that Dr. *Tournefort* will have the *Chelidonium* among the *Flores Cruciformes*, and the *Glaucium* among the *Flores Roſacei*, upon no other account than the Largeneſs of the *Petalæ* in the one, and Smallneſs in the other. *Fumaria* is not right plac'd betwixt the *Chelidonium* and *Raphanus*, *Lyſimachia*, as being *Quadricapſular*, and the *Flower* being upon the top or the Pod may be plac'd elſewhere. *Papaver Capitatum* ſhould

ſhould not come in here, becauſe its Head is not properly a *Siliqua* but a *Capſula*, no more than *Balſamina Fœmina*, becauſe of the Faſhion of the *Flower* and *Fruit*, which is *Unicapſular*, not *Multicapſular*. *Veronica* is but ill join'd with the *Tetrapetalæ Siliculoſæ*, becauſe it has a *Monopetalous Flower*; nor do I well know, whether its *Fruit* ſhould not rather be call'd a *Capſula* than a *Silicula*, though it in ſome meaſure reſembles that of the *Burſa Paſtoris*: Nor has the *Polygalæ* much to do with this Place, either by *Flower* or *Fruit*.

Sect. 4. goes pretty *regularly* on with the *Monopetalous Flowers*, divided into 6 *Segments* or *Hexapetalous* ones; to all which ſucceed a *Tricapſular Fruit*, till it come to Chap. 25. at the ſecond Diſtribution; and then I do not ſee how the *Anemone*, *Caryophyllata*, *Ranunculus*, and *Hepatica Nobilis* can come in.

Sect. 5. Has its *Title* from the Number of the *Capſulæ* and *Petala*. This, as much as any, wants to be more regularly diſpos'd; for it ſeems the Doctor had heap'd them up without any ſpecial Regard, either to *Flower* or *Fruit*, *v. g.* If according to the *Fruit*, then the *Unicapſulares* ſhould have begun, and the reſt of courſe, according to the Number, as *Anagallis*, *Nummularia*, *Auricula Urſi*, *primula veris*, among the *Monopetalæ*. *Caryophyllus*, *Lychnis*, *Linum*, *&c.* among the *Pentapetalæ*. The *Bicapſulares Monopetalæ*

læ might have follow'd, as *Digitalis*, *Scrophularia*, *Antirrhinum*, *Linaria*. Next to them ſhould have been the *Tricapſulares*, *Monopet. Lacteſcentes*, as *Campanulæ ejuſque Species*, *Rapuntium*, and *Pentapetalæ*, *Hypericum*, *&c.* though, according to Mr. *Ray*, there are ſome of the *Hyperica* are *Quinquecapſulares*, *Aſarum*, ſo called by *Tournefort*, or *Androſemum*, *Flore & Theca quinque-capſulari omnium maximis*, *Moriſ.* which is a Species of the *Hypericon*. But of theſe, and the like, I could give many more Examples, both in this ſecond Volume publiſh'd by himſelf, and likewiſe in the third, publiſh'd by Mr. *Bobart* after his Death, to ſhew, that though he was the firſt who brought Method to any regular Footing, yet the ſhort time he liv'd, and the want of Aſſiſtance for ſo great a Performance, are two very great Reaſons why he did not bring *Method* to that Perfection he might have otherwiſe done: And as I have already told how he encreas'd the Number of his *Sections*, had he been more exact in the Manner of diſpoſing his *Chapters*; and had he conſidered a little farther of the *Number* of the *Petala* in the Flowers, or look'd upon them to be of as great moment as they have been ſince he wrote, his *Method* had been better look'd upon, his Enviers had not had ſuch an Opportunity to detract from his Fame; and Method it ſelf had arriv'd at a far greater Perfection,

fection, had not his untimely Death prevented it; so true is the Proverb, *Better is a living Dog than a dead Lion.* How great a Length he had gone, in order to bring *Method* to Perfection, let any impartial Reader judge; when they consider, with what Accuracy he return'd every particular Species to its proper *Genus*, and how exact he was in the Description of them, at a time when scarce any knew how to give a tolerable Description of any particular *Plant:* So that the *Tetrastick* compos'd by the *Celebrated* Dr. *Pitcairn*, and subjoin'd to his Picture, will seem to be no *Hyperbole* to those who shall seriously peruse his Writings.

Quæ, Morisone, *viro potuit contingere major*
Gloria, Pæonium quam superasse Genus?
Ipse tibi palmam Phœbus concedit Apollo,
Laureaque est Capiti quælibet Herba tuo.

Ray's *Method.*

Mr. *Ray*, his Competitor, was the next who attempted any thing upon *Method.* He from his Infancy had a great *Genius*, not only for *Botany*, but for all the other Parts of the natural History: Beside that, he had a peculiar Faculty of excerpting from *Authors* what made for his Purpose, when he betook himself to any particular Science. This set him early in the Humour of writing. His first Essay was the *Catalogus Plantarum Circa Cantabrigiam*;

where he tells, in the Preface, what Difficulties he ſurmounted, before he could arrive at any tolerable Degree of Knowledge in the *Botany*, for want of knowing *Botaniſts* to teach him, and having only Books to rely upon, whoſe Deſcriptions were often faulty; That after ſome time he began to conſider to what Tribe or Family each Plant did belong: but as *Method* at that time was not underſtood, his Knowledge that way could not be very great. At length, he ſays, after ſix Years he began ſeriouſly to think of compoſing a Catalogue of Plants, which naturally grow near to *Cambridge*. He was three Years in perfecting this Work, and at laſt he publiſh'd it in *Anno* 1660[x]. but did not think fit to fix his Name to it, until he ſhould ſee how this his firſt Eſſay would take. The Catalogue, conſidering that neither the *Botany*, nor *Method* of deſtributing Plants were as yet well underſtood, is tolerably well done. It's the Effect of a good deal of Reading, and there are here and there not unfit Obſervations upon ſeveral of the *Plants*, chiefly concerning their *Virtues*, but few or none in rectifying of the Deſcriptions of the Plants given by Authors, or of their *Genera*; and they being Alphabetically diſpos'd, he had no Difficulty in the Diſtribution. *Gerard*, *Park.* and the *Bauhini*, were they whoſe Names he generally made uſe of.

[x] Præf. ad Catalog. Plant. Circa Cantabrig.

About

About seventeen Years after this, *i. e. Anno* 1677. having now travelled all over *England*, as himself informs us, and understanding that the *Cambridge* Catalogue was sold off, and that a new Edition was wanted, he enlarg'd the Bounds, and compos'd a Catalogue of all the *English* Indigenous Plants, entituled, *Catalogus Plantarum Angliæ & Insularum adjacentium.* In the Preface to this, he promises shortly to publish his *Nova Methodus.* And now he seems to be fitted for such an Undertaking; for *Morison*'s *Præludium Botanicum* had been publish'd eight Year before, and no doubt such a diligent, inquisitive Person, as he was, would be sure to excerpt whatever was fit for his Purpose, as himself acknowledges. His Observations chiefly consist in enumerating the Virtues, for as yet he had not accustom'd himself to the making Observations upon the Plants themselves; and indeed that seems to have been much his Failing, throughout the whole Course of his *Botanick* Writings; that he trusted more to the Observations of others than to his own: Which thing expos'd him first, to the Censure of Dr. *Morison*, who thought it strange, that Mr. *Ray* should still retain the Names, continue to acquiesce in the Errors, and yet compeal with him, who made it his continual Business to detect the Errors of others, by proper Observations of his own. This it was which made Dr. *Morison* often say, that Mr.

Ray ſtudied Plants more in his Cloſet than in Gardens and Fields; and this was the firſt Ground of Contention betwixt them: For Dr. *Moriſon* being a plain dealing Man, and one who would tell the Truth at all Hazards, did not fail to tell it upon all Occaſions; eſpecially ſince he underſtood that he was ſet to work in *Methodiſing* of Plants, when he ſcarce knew their *Characters* by ocular Inſpection: And it was the Tartneſs of this ſevere, though true Reflection, which created ſuch a Reſentment in Mr. *Ray* againſt Dr. *Moriſon*'s Memory, even after the Doctor's Death, that he never forgot it to his dying Hour, as is already declar'd. Nor was this Diſeſteem of him upon that account, only harbour'd by Dr. *Moriſon*, but by all Foreigners, who had occaſion to ſee his Writings; This it was which gave occaſion to Dr. *Tournefort* to reflect ſo much upon his want of proper Obſervations upon Plants in his *Elementes Botaniques*, as Mr. *Ray* himſelf takes notice [y].

It was this which made his Hiſtory ſo little valued abroad; and this made even his *Methodus Emendata* receive ſo little Encouragement here in *England*, that he was forc'd to ſend it to *Holland*, and make uſe of the Intereſt of Dr. *Hotton*'s Influence, before he could get it publiſhed there.

[y] Verum dum paginas negligentius revolvo, me ſæpius nominatum totieſque fere notatum ac reprehenſum invenio. Raii Epiſt. ad. Rivinum. Poſtc. p. 52.

Indeed

Indeed if we consider the Inconveniencies Mr. *Ray* laboured under, when he set to work about his *Nova Methodus* [z], it may be look'd upon as a Piece of the greatest Boldness to attempt it; and it is very much that he got it perform'd, faulty as it is: But, as is said, he was oblig'd to Dr. *Morison*'s *Præludia* and *Hallucinationes* for it, which he himself does not deny [a]; and therefore though he assum'd the Title of it to himself, yet the Foundation is Dr. *Morison*'s. This *Nova Methodus* being published *anno* 1682, he immediately after that compos'd his General History in two Volumes, which he publish'd four Years after. This is chiefly taken from *J. Bauhinus*, his Brother *Caspar*, *Clusius*, *&c.* as also from Dr. *Morison's non Descripts* in his *Præludium Botanicum*, and but a very few Observations of his own. So that these Volumes owe no more to him than the Pains of Collecting, and the *Method* of *Distribution*, which is altered a little from the *Nova Methodus*, but not purg'd of its Imperfections, as is by him-

[z] Cùm species plantarum hactenus cognitas nondum viderim, nec dum descripserim; cúmque rure degam Londinio aut Oxonio procul nec Hortus Botanicus in propinquo esset quem nondum satis exploratas inspecturus adeam nec mihi ad plantas conquirendas, coemendas otium aut facultates suppeditant.

[a] Nec reticere debeo me è D. *Roberti Morison* M. D. & Botanices professoris Oxonienſis præludii Botanici & historia plant. universal. mutuatum esse quæ ad rem nostram facere videbantur. Raii Præf. ad Nov. Method.

ſelf own'd in his *Methodus Emendata*[b]; and what is the Opinion thoſe abroad have of it, is to be ſeen in *Rivini*, his Epiſtle to him[c].

The next Treatiſe he publiſh'd was his *Sylloge Stirpium extra Britannias Naſcentium*, which is compos'd of ſeveral Catalogues of Plants, either obſerv'd by himſelf in his Travels, or excerpted from Authors. His Genius ſeems to have been much bent towards the writing of Catalogues, and finding out the *Locus Natalis*, which is of no ſmall uſe to thoſe who travel to thoſe Parts mentioned by him; and it had been no ſmall Advantage to the *Botany*, if he had underſtood *Method*, at the time he obſerv'd where the Plants grew, ſo far as to give the Characters of the Plants, when he had ſo many good Opportunities of ſeeing them. In the Preface to that Volume there are are two things remarkable.

1. He takes notice of the Male and Female Flowers in the Plants, and goes into Dr. *Grew*'s Sentiments, concerning the Manner of *Fœcundation* of the Seed; which I ſuppoſe he has taken from what Dr. *Grew* advanc'd upon the Subject: But of this more hereafter.

[b] Quod Methodum illam qua in hiſtoria plantarum ſtirpibus diſpondendis uſus ſum, ſuis etiam defectibus & vitiis laboraretur, ipſe animadverti, tum ab aliis admonitus ſum. Præf. ad Meth. Emend.

[c] Verum de methodo, Deo vitam prorogante vireſque & valetudinem largiente, in poſterum promittis, (Præf. ad Syllogen. p. 19.) utinam id factum fuiſſet ante hiſtoriam plantarum editam. Sat cito attamen ſi ſat bene. Rivini Epiſt. ad Johannem Ravium. p. 13.

2. He

2. He takes notice of *Rivini*'s Method, which gave ground to the *Dissertatory* Epistles betwixt *Rivini* and him; as also to the *Dissertatio de Variis Methodis*, where he takes *Tournefort*'s *Method* to task.

His *Catalogus Plantarum Angliæ* being well receiv'd, and he by this time having arriv'd at a competent Degree of Knowledge in *Method*, undertook the disposing of the *British* Plants (formerly receiv'd alphabetically) into his *Method*, under the Title of *Synopsis Stirpium Britannicarum*.

Dr. *Morison* being dead, and the Science of *Botany*, by his Influence first, and now by Mr. *Ray*'s Industry, having put on a quite different Face, and begun to flourish more in *Britain*, by the indefatigable Endeavours of a great many knowing and ingenious Persons: And Mr. *Ray* having begun of a long time to write, all the *British Botanists*, as one Man, entertain a Correspondence with him, and communicate to him whatever they found worthy of Observation. So that if Mr. *Ray* began to write with great Disadvantages, no Man had better Opportunities to write afterwards to good Purpose than he had; nor to become a most famous and celebrated *Botanist*; nor was there any Science which made greater Advances in this learned Age than the *Botany* did, during the Life of Mr. *Ray*. By Dr. *Morison*'s Death, Mr. *Ray* had no Competitor. *Botanists* abroad had not thought

of any other *Method* than Dr. *Moriſon*'s till Mr. *Ray*'s appear'd: And Mr. *Ray* being now more fully inform'd of the Indigenous Plants, his *Method* alſo being now brought to a greater Perfection, he diſpoſes of them according to it. This is a notable Performance, and moſt deſerving of the Name of one, who had now acquir'd ſo great Fame. In this he has the Civility every where to acknowledge his Benefactors; neither does he keep up from any what is due to them, except Dr. *Moriſon*, whoſe Diſtribution he often uſes, without aſcribing his Name to them; as can be made appear from ſeveral Inſtances: I ſhall only name one. In the former Catalogues he followed *C. Bauhinus*, in the Diſtribution of ſome of the *Alſine's* and *Anagallis aquat.* but now he makes them all *Veronica's*, being taught ſo to do by *Moriſon*'s *Præludium Botanicum* and *Hiſtory*, and yet points out this Diſtribution as his own. For an Example ſee the following Note*. For as all *Botaniſts* have

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* Alſine fol. Tuſſag. Raii Cat. Cant. Cat. Plant. Angl.

Alſine fol. Veronic. Ibid.

Alſine Hederacea. Ibid.

Anagallis aquat. Min. fol. Subrotund. Cat. Cant. p. 10. Cat.

Veronica Floribus Singularibus in oblongis Pediculis Charmædrifolia Raii Syn. Stirp. Brit. p. 178. Moriſ. Halluc. 392.

Veronica Floſc. Singularibus Cauliculis adhærentibus. Ib.

Veronica Floſculis Singularibus Hederulæ fol. Ibid.

Veronica aquat. Rotundif. beccabunga dicta minor. Synopſ.

have the Civility towards one another, to mention the Author, either of a new Diſtribution, new Genus, or new Name of a Plant, ſo Mr. *Ray* fail'd in this, that he gives *Moriſon*'s Diſtribution of theſe Plants among the *Veronica*'s, but does not mention *Moriſon*'s Name; by which they who know nothing of it will be ready to take them for Mr. *Ray*'s own Diſpoſition; whereas had he affix'd the Name *Moriſ.* to them, he had done more for his own Credit than otherwiſe.

Mr. *Ray*, I ſay, is ſo juſt to his other Correſpendents, that he mentions every one of them with that juſt Regard and Gratitude they truly deſerve at his Hands. In that elaborate Treatiſe therefore, he every where acknowledges Mr. *Dale* his Fellow-labourer, Mr. *Dodſworth*, *Doody*, *Lawſon*, *Lhuyd*, *Newton*, *Petiver*, Dr. *Plot*, *Pluyknel*, *Sloane*, *Sherard* and *Robinſon*; nor is the ingenious Mr. *Jacob Bobart* to be forgot, whom with Mr. *Walter Moyle*, and Mr. *William Vernon*, he adds, as his Benefactors, in the Preface to his ſecond Edition.

Cat. Plant. Angl. p. 19.

Anagall. aquat. Min. fol. oblong. Ibid.

Anagall. aquat. Min. fol. Auguſtifol. fol. Ibid.

Chamædris Sylveſtr. Spuria Cat. Cant. p. 32. Cat. Plant. Angl. p. 64. Synopſ. Stirp. Brit. 178. Moriſ. Halluc. 393.

Veronica aquat. Longifol. Media. Ibid. Min. fol. oblong. Moriſ. Ibid.

Veronica aquat. Auguſtif. Min. Raii. Ibid. Aquat Auguſtif. Moriſ. Ibid.

Veronica Chamædris Sylv. dicta. Ibid.

This

This is a Set of such *Eminent Botanists*, as no Nation can produce the like Number to have flourish'd in any one Age at once, or within so small Bounds, most of which either have, or are about to publish elaborate Treatises of their own Composure upon that Subject; among whom the whole Society of *Botanists* throughout the World are big with the Expectation of that incomparable *Pinax*, as the Work of so many Years indefatigable Endeavours, the Product of so numerous and unparallell'd a Collection of Specimens, and the effect of so vast a Correspondence which that eminent *Botanist*, Dr. *William Sherard*, whom *Dillenius* and many others, call *Botanicorum Anglorum decus singulare* [d], or as *Volkhamer* says, that he is *Botanicus Anglicus sine pari inque Naturalium Historiâ versatissimus*, has kept for many Years, every where, whither the ordinary Course of Commerce, his extraordinary Fame for his Skilfulness in *Botany*, or his own Personal Presence could lead him; so that if great Assiduity, and indefatigable Pains in searching after the Plants themselves, and the collecting of *fair Specimens* in most of the Habitable Parts throughout all *Europe* and *Asia*, visiting the most curious *Gardens* every where, and obtaining from thence whatever was rare and curious, which the most eminent *Botanists*, where-

[d] Præf. ad. Nov. Gen. Plant.

ever

ever he went, had the greateſt Fondneſs to afford him. I ſay, if all theſe, together with his own Accuracy in obſerving the Plants or Specimens, and moſt intimate Knowledge how to diſpoſe them into a *Method*, can render a Work compleat that may be expected of Dr. *Sherard* his *Pinax*, which 'tis hop'd will, e'er long, ſee the Light, if a continual Supply of new Specimens and Non Deſcripts do not retard it, by ſtill affording new Work, in diſpoſing each of them according to their true *Genera* and *Species*, by which we may expect That *Method*, (which is at preſent the occaſion of great Diſputes) may receive the finiſhing Stroak.

Mr. *Ray* being thus furniſh'd with Correſpondents at Home, and the Aſſiſtance of thoſe eminent *Botanick* Authors abroad, who having learn'd how to diſpoſe *Plants* into a *Method*, from thoſe of *Britain*, and in their Turn had begun to cultivate *Botany*, and frame new *Methods*, thought it convenient to publiſh a Supplement to his Hiſtory, and correct his former Method; Therefore, having collected from *Herman*, *Rivini*, *Tournefort*, *Volkhammer*, *Plumier*, *Commelli*, *Commelin*, *Hortus Malabaricus*, and others mention'd in the Preface, he from them, together with what Materials his *Britiſh* Friends afforded him, compos'd a Third Volume of Hiſtory, as big as any of the two former; among theſe, that accurate and expert *Botaniſt*

nist, and most diligent and curious Natural Historian, Sir. *Hans Sloane*, Baronet, and M. D. gave no small Assistance, whose extream Knowledge of the *Plants* very well appears, by his *Catalogue* of *Jamaica Plants*, from that great Number of *Non-descripts*, whereof he communicated the Manuscript Description to Mr. *Ray*, and which make up no small part of his *Supplement*, and from his *Natural History* of *Jamaica*, whose diligent Search and Enquiry after all Kinds of *natural Productions*, and whose immense Collection of the *Specimens* of all Kinds of *Plants*, which with his rich Cabinet of *Medals*, choice Library of *Books*, and other remarkable Pieces of Art, serve to make up one of the most valuable *Musæums*, or Chamber of Rarities, that is this Day to be seen any where, especially in the Hands of any private Person: To which Mr. *Petiver*'s Collection of *Rarities*, dry'd *Specimens* of *Plants*, and *Books*, has of late made no small Addition. That late curious and most indefatigable, celebrated Author, by his singular Knowledge in all the Parts of the *natural History*, particularly of *Plants*, by his great Industry and unwearied Diligence in traversing most Parts of *England* and *Holland*, by keeping Correspondence with most of the *noted* and *ingenious natural Historians* every where; by his daily receiving of new Supplies of *natural Productions* from all Parts of the World, made up

up a most curious Collection of Rarities; and by his *Musæum*, *Gazaphylacium Artis & Naturæ*; *Collection* of *Amboina Shells*, and *American Ferns*; also by the *Prints* of his *British Herbal*; and last of all, by his *Hortus Siccus*, which makes up so good a part of this *Supplement* of Mr. *Ray*, (all which are now in the Custody of Sir *Hans Sloane*) acquir'd immortal Fame during his Life, and has left a perpetual Memorial of his Labour, Industry and Pains behind him, by the fore-mention'd Writings and Prints, which are now dispers'd every where.

But that which has render'd Mr. *Ray*'s *Supplement* the more compleat, is the considerable Help afforded him by Dr. *Sherard*, who not only inrich'd it, by the Addition of a great many *Non-descripts*, but also by his Goodness and Civility towards him, in comparing and correcting his Manuscripts, and fitting them for the Press, when himself, through Weakness and old Age, had not Strength to perform it.

And now I am come to his long look'd for, and much wanted *Methodus Emendata & Aucta*. Dr. *Morison*'s *Method*, by his untimely Death, never was compleated, for it still wants the first Part, which is that of the *Trees* and *Shrubs*. His own *Nova Methodus*, by the great Advancements *Botany* had made every where, was found erroneous; those abroad were now fam'd for *Method*, when

when it was almoſt worn out in *Britain*, where it firſt began: Therefore Mr. *Ray* found it convenient to correct what he had formerly writ upon that Subject, and to enrich it with new Obſervations and Characters of *Plants*, from *Herman*, *Rivini*, and *Tournefort*, and from what his *Britiſh* Correſpondence communicated to him; among whom was that *ingenious* and moſt expert *Botaniſt*, Dr. *Charles Preſtone*, Intendent of the *Phyſick-Garden* at *Edinburgh*; ſo that it is now render'd a moſt compleat Work, and one of the beſt Performances upon that Deſign. But the Science of *Botany* is ſo very extenſive, and to write upon *Method* depends ſo much upon the particular Obſervations made upon the *Plants* themſelves, that upon further Examination, this *Method* of Mr. *Ray* is not yet purg'd from all its Defects, which ſince *Dillenius*, of whom hereafter, has undertaken to correct and ſupply, I ſhall leave it to him and proceed to give a ſhort Account of the *Method* it ſelf.

He divides the *Plants*, firſt into the *Plantæ non Floriferæ*, and *Floriferæ*. I love this Diſtinction much better than his former, which is ſtill us'd in his *Supplement*, *viz.* into *Plantæ Imperfectæ* and *Perfectæ*, though both proceed from the ſame Reaſon, becauſe there are a great many *Plants*, which at firſt View, without the help of Magnifying-glaſſes, appear to have neither *Flower* nor *Seed*;

but that all *Plants* have both, is now plainly made appear, from the curious Obſervations of ſome late, modern, nice Obſervers of *Plants*, particularly of Mr. *Geoffroy* in the Vegetation of the *Truffles* or *Tubera Terræ*, and [e] Mr. *Reaumur* upon the *Flower* and *Seed* of ſeveral *Fucus*'s; [f] and other *Marine Plants*, [g] and ſeveral others, notwithſtanding what *Dillenius* may alledge to the contrary, as has been obſerv'd. Under the Head of the *Non-floriferæ*, are comprehended the *Fuci*, *Fungi*, *Muſci*, *Submarinæ* and *Capillares*.

Mr. *Ray* divides the *Floriferous Plants* into *Dicotylidones* and *Monocotylidones*; the *Dicotylidones* are they whoſe *Seed* ſends forth two *Seed Leaves* when it ſprings, and the *Monocotylidones* only puſh forth one.

The *Dicotylidones* are *Herbæ Flore Stamineo*; theſe in his *Hiſtory* and *Supplement* are claſs'd among the *Plantæ Imperfectæ*, becauſe the *Flowers* have no *Petala*, but only *Stamina* and a *Calix*: Then he goes on with the *Lacteſcentes* and *Pappeſcentes*, *Corymbiferæ* and *Capitatæ*, of all which we have given ſome Hints already.

From them he proceeds to the *Flore Perfecto Simplici*, *Semine nudo Solitario*, as *Valeriana*, *&c.* the *Umbelliferæ* or *Gymno Di-*

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[e] Memoir del Academie Royal de Sciences pour L'an 1711. p. 29. [f] P. 371. [g] Pour L'an. 1712. p. 28. Edit. Amſterdam.

ſpermæ,

ſpermæ, whereof ſomewhat already; the *Stellatæ*, *Aſperifoliæ*, and *Verticillatæ*. The *Notes* of all theſe three, are chiefly taken from the Diſpoſition of the *Leaf*.

Then he goes on to conſider them in their Fructification, as *Semine Nudo Polyſpermæ*; *Herbæ Pomiferæ*, *Bacciferæ*, *Multiſiliquæ*, *Vaſculiferæ*, and flavoring *Flore Monopetalo*, *Dipetalo*, *Tetrapetalæ Siliquoſæ*, and *Leguminoſæ*.

The *Monocotylidones*, are *Gramini-foliæ Floriferæ*, *Vaſculo Tricapſulari*, *Bulboſis Affines*, of which already, *Griminifoliæ Culmiferæ*, as the *Frumenta* and *Gramina*; and laſt of all, the *Anomalæ*, or *Incertæ Sedis*.

The *Trees* are divided into the *Flore à Fructu remoto*, as the *Coniferæ*, *non Coniferæ*; *Quercus*; *Piluliferæ*, *Platanus Lanigeræ ſeu Pappoſæ*, *Populus Salix*, and *Bacciferæ*, as *Myrtus*, *Juniperus*, *Taxus*, *Morus*.

The *Arbores fructu contiguo*, are *Pomiferæ* and *Bacciferæ*, *Umbilicatæ*, *Pruniferæ ſeu Teſtaceæ*, or Stone-Fruit; *Pomiferæ* and *Bacciferæ non Umbilicatæ* as *Malus Aurantia*, *&c.* among the *Apples*; and *Viſcum* among the *Berries*.

They are in the third Place, divided into *Fructu Sicco*, as *Acer*, *Fraxinus*, and *Siliquoſo non Papylonaceo*, as *Sena*, *Caſſia*, *&c.* *Papylonaceo*, as *Anagyris*, *Collutea*, *&c.*

Thus

Thus I have briefly given an Account of all the *Botanick* Writings and *Method* of Mr. *Ray*, of whom to give an impartial Character, I cannot do it more truly than in his own Words, when speaking of *Johannes Bauhinus*, viz. "*That he was a Man of great* "*Learning, a faithful Friend, of infinite Rea-* "*ding; of a ripe Judgment, and thoroughly* "*acquainted in all the Writings of the mo-* "*dern and ancient* Botaniſts, *and moſt con-* "*verſant in all kind of human Literature*"[i]; particularly the *Natural Hiſtory*, in which he made a vaſt Proficiency, as well in the Animal and Mineral, as in the Vegetable Kingdoms; He laboured under great Diſadvantages at the beginning of his Studies, but that was afterwards ſufficiently recompens'd, by the vaſt Number of Correſpondnts he had towards the latter end of his Days, and happy had it been for *Botany*, had he been at Pains to examine the *Plants* themſelves before he began his *Method*, and continued to make his proper Obſervations upon them, before he publiſh'd any other of his *Botanick* Works; His Writings would not have needed ſo many Corrections, Amendments, and new Editions:

[i] Vir Eximiæ eruditionis, ſummæ fidei, infinitæ Lectionis, maturi judicii, in omnibus Botanicorum, tam antiquorum quàm recentiorum ſcriptis verſatiſſimus, omni humanioris & ſeverioris literaturæ verſatiſſimus. Raii Cat. Plant. Circa Cantabrig. Explic. nom. Auth.

Nor would he have been so much expos'd to the Obloquy and Reproach of others during his own Life.

In a word, He was a great and good Man, and did not behave unworthy of himself in any thing, so much as in that cruel Resentment he always had against Dr. *Morison*'s Memory; in which perhaps it may be thought I have insisted too long already; but all I design'd thereby, was to give an impartial Account of the ground of the Debate betwixt them.

As to his *Method*, I can give no better Account of it, than that of the celebrated Dr. *Tournefort*, who having reflected too much against him in his *Elementes Botaniques*, was advis'd to desist from so doing in his *Institutines Rei Herbariæ*, by that *ingenious* and *expert* Botanist, *Dr. Charles Preston*, as himself intimates in his Letter to Mr. *Ray*, and therefore Dr. *Tournefort* says no more of him, but gives this just *Character of his Method.*

" *John Ray*, Fellow of the *Royal-Society*
" of *London*, was one who left nothing of
" almost all the Parts of the *Natural History*
" untouch'd; he was not contented with ha-
" ving collected, illustrated, and digested into
" one Body, the best Things that are to be
" found in every one of the *Botanick* Wri-
" ters, and to have added several new *Plants*,
" but he also handsomely distinguish'd all the
" *Plants*

" *Plants* already known, attributing to " every one their proper *Notes* [h].

I have now done with these two great, *British Botanick* Lights, who have favoured the World with such Discoveries and Improvements as have been since sufficient to exercise the Fancies of the curious *Botanists* every where Abroad, and as an *eminent Botanist* lately observ'd to me, that Dr. *Morison* is to be valu'd for his Discovery of *Method*, as Dr. *Harvey* for the *Circulation of the Blood*, though there are not wanting Malevolent Writers, who would deprive both of that just Honour and Praise that is due to them for so valuable Discoveries. But 'tis not they alone whom the envious *Foreigners* would deprive of their true Merit; in spite of which *Britain* still remains happy in a great many other valuable Discoveries and Improvements made within her Borders, which no other Nation can pretend to the like, let grinning Malice do her worst.

Paulus Ammannus was the first after Mr. *Ray*, who attempted any thing of *Method*; he pub- *Ammannus* Method.

[h] Johanni Raio, socio Regio Londinensi, qui nullam fermè historiæ naturalis partem intactam reliquit. Non fuit satis quæcumque optima in singulis plantarum scriptoribus occurrunt in unum corpus coacervâsse, digessisse, illustrâsse, quam plurima nova addidisse; plantas etiam hucusque cognitas in sua genera pulchrè distinxit, singulorum proprias notas recensens. Tourn. Isagog. 53.

liſh'd his *Character Plantarum Naturalis à ſine Ultimo, viz. Fructificatione deſumptus.* He treats of the *Plants* Alphabetically, and aſcribes Dr. *Moriſon*'s Notes to them, without any conſiderable Alterations. The Treatiſe is but ſhort, and only deſign'd for a Pocket Volume. This he publiſh'd at *Leipſick, Anno* 1685 This ſmall *Manual* is reprinted at *Frankfort, Anno* 1701. by Dr. *Nebelius,* who has enlarg'd it with Annotations, chiefly compos'd of Obſervations taken from other *Botanick* Authors ſince the firſt Publication.

Herman's Method.

The next is Dr. *Herman,* one of the moſt conſummate *Botaniſts* of this laſt Age: He was Profeſſor of *Botany* at *Leyden,* and travell'd aſſiduouſly in rectifying of Dr. *Moriſon*'s *Method*; for as has been told, Dr. *Moriſon,* by his untimely Death, left his *Method* incompleat; Mr. *Ray* liv'd to ſupport the Authority of his, but Dr. *Herman* not being pleas'd with it, as not being brought to that Perfection he wiſhed for, preferr'd Dr. *Moriſon*'s to it, as aiming at a more regular way in diſpoſing of the *Plants* according to their *Fructification,* and has alter'd it in ſuch a manner, that it ceas'd any more to be Dr. *Moriſon*'s, but Dr. *Herman*'s; as if one by repairing of an Houſe, ſhould ſo alter the ſeveral Apartments in it, that it may rather be call'd a new Houſe, built upon the former Foundation. He

He begins with the Consideration of the Number, Disposition, and other Accidents belonging to the *Seeds*; therefore they are, according to him, either *Gymnopolyspermæ*. Here he justly places *Chelidonia Minus*, *Hepatica Nobilis*, along with the *Ranunculi*; as also *Adonis* and *Anemone Nemorosa*, and its *Congeners*; neither are the *Pentaphylla*, and *Pentaphylloides* unfitly brought to this Neighbourhood. Most of this Class are *Pentapetalæ* or *Polypetalæ*, but then he subjoins the *Malvaceous Class*, which is wrong, both upon Account of the *Monopetalous Flower*, and *Capsular Fruit*.

The next are the *Gymnodispermæ*, or *Umbelliferæ*, because of the two *Seeds* succeeding to each *Flower*; and since he has so little regard to the *Flower*, he might have subjoin'd the Tribe of the *Rubia's*, *Aparine*, *Asperula*, *&c.* for they have *Bina semina post singulos Flores*, and are sometimes *Umbellatim dispositæ*, as in *Asperula*, and their having *Monopetalous quadripartite Flowers*; and *Stellate* or *Radiate Leaves* did not hinder their being brought into the Neighbourhood of the other, since they were to be led only by the Disposition and Number of the *Seed*.

3. *Angiomonospermæ*, when one *Seed* succeeds to each single *Flower*. *Valeriana* is justly separated here from the *Valerianella*, because of its having a *pappous Seed*. Mr. *Ray*

joins all the *Plants* of this Tribe together, under the Title of *Plantæ flore ſimplici ſemine nudo ſolitario poſt ſingulos Flores* [k]; and I doubt if any of them will anſwer it; for each *Seed* of the *Valeriana*, as is rightly obſerv'd by *Knaut*, has a ſtriated *Capſula*, in which each oval-pointed *Seed* is contain'd. *Valerianella* has a *Capſula* conſiſting of two Parts, yet generally having but one *Seed*, one part of the *Capſula* for the moſt part being empty, as is well obſerv'd by *Tournefort*, though *Rivini* would have two *Seeds* to ſucceed each *Flower*, by which it might be claſs'd among the *Umbelliferæ*, according to Mr. *Ray*, but ſince that do's not always hold, and that *Characteriſtick Notes* are not to be taken from accidental Excurſions, it may be very well plac'd among the *Monocarpi*, as all the others of this Claſs deſerve to be. The *Mirabilis Peruviana*, now found out to be the *Jallapa*, ſeems to me to be a *Monocarpos*, for it can eaſily be ſtrip'd of its outer Coat, when not dry'd up; and the *Capſulæ* of all the *Monocarpi* are ſo even, the *Fruit* of the *Agrimonia* will not eaſily open when dry, tho' when it uſually contains two *Seeds*; neither will the *Seeds* of the *Malva*, ſome *Trefoils* and *Melilots*, nor *Fumaria*, eaſily quit their *Capſula*; though now, by the Conſent of moſt *Authors*, all of them have a *Capſular Fruit*

[k] Meth. emend. p. 44.

I think,

I think, as has been obſerv'd. *Circea* comes very well in, next to the *Agrimonia*, as to their *Fructification*, and therefore the *Flora Batava* might have ſpar'd a new Title, by making *Circea Angioſpermos*, and *Agrimonia Angioſpermis Affinis*, or *Monocarpos*, whereas its truly *Dicarpos*.

After this he goes on with Mr. *Ray* in the Enumeration of the *Pappeſcentes & Lacteſcentes*, *Pappeſcentes non Lacteſcentes*, *Capitatæ ſive Floribus Fiſtuloſis*, *Planifoliæ non Pappeſcentes & Lacteſcentes*, *Corymbiferæ ſeu ſeminibus ſolidis*, but do's not diſtinguiſh betwixt the *Nudæ* and *Radiatæ*. *Ageratum ſive Eupatorium Meſues*, by what I could yet obſerve, is a *Ptarmica*, and therefore is juſtly call'd by *Tournefort*, *Ptarmica Lutea Suaveolens*, of which I convinc'd Dr. *Preſtone* long ago; and *Draco Herba*, or *Tarragon*, ought rather to be plac'd among the *Abrotana*, than betwixt *Artemiſia* and *Tanacetum*. *Scabioſa* might go along with *Cyanus*, and therefore there is no need of a new Title; ſuch as *Floribus Pluribus in Capitulum Congeſtis*. *Eryngium*, is juſtly plac'd by *Tournefort* among the *Umbelliferæ*.

Next to theſe follow the *Stellatæ*, *Aſperifoliæ*, and *Verticillatæ*. I have obſerv'd, that the *Stellatæ* ought to ſucceed the *Umbelliferæ*. The *Aſperi-foliæ* and *Verticillatæ*, may very well follow each other, by the Reaſon of four *Seeds* ſucceeding to each

Flower, but then, according to the *Method* laid down, the Title ſhould have been alter'd, and the *Stellatæ* ſhould have been entituled, *Gymno diſpermæ*, and the other two, *Gymnotetraſpermæ*, with which *Lyſimachia Galericula*, or *Caſſida* of *Columna*, and *Dracocephalion* may be join'd, but not as *Affines*, being truly of the ſame Family by the *Fructification*; from whence we may ſee the Inconveniency of *claſſing*, by the *Diſpoſition* of the *Leaf*, for none of them are *Plantæ Verticillatæ*, and ſcarcely *Spicatæ*.

After them come the *Capſular Plants*, as *Unicapſularis*, but then here ariſes a great Confuſion in reſpect of the *Flower*. *Primula Veris*, *Auricula Urſi*, are *Monopetaloſæ*, and *tubulated*. *Alſine*, *Lychnis*, *Caryophyllus*, have *Polypetalous*, or *Pentapetalous Flowers*, with a *Tubulous Calix*. *Anagallis*, *Nummularia*, are *Monopetalous*, not *Tubulous*. To which may be added, *Portulaca*, *Hydrophyllum*, *Glaux*; but *Trifolium Paludoſum*, plac'd betwixt the two laſt, has a *Tubulous Flower*, ſo that to render this Tribe of the *Unicapſular Plants* more *regular*, it had been convenient to have diſtinguiſh'd them into *Monopetalous* and *Polypetalous Flowers*, and the *Monopetalous* again into thoſe which have a *Tubulous Calix*, and which not.

2. *Bicapſulares*. Here ariſes another *Confuſion*. *Centaurium Minus*, *Lyſimachia*,

chia Lutea, *Seda Bicornia*, *ſeu Saxifragæ Albæ Species*, *Blattaria*, *Verbaſcum*, *Gentiana*, *Digitalis*, *Gratiola*, are all *Monopetalous Flowers*, either divided into equal *Segments*, or having equal Borders; to which may be added, *Hyoſcyamus*, *Nicotiana*, whereas *Acanthus*, *Antirrhinum*, *Linaria*, *Scrophularia*, *Pedicularis*, *Melampyrum*, *Euphraſia*, *Polygala*, are for the moſt part *Calcaris Donati*, or *Labiati*; the *Veronica* may be claſs'd in with the former, *i. e.* with the *Flowers*, which have more equal *Segments*. *Gentiana*, and *Centaurium Minus*, ought either to be join'd together, or immediately to follow each other, becauſe of the Proximity of their *Characters*; *Facies externa Taſte & Virtues*; all the *Saxifraga's* are *Polypetalous*, except the *Aurea*, and therefore they ought to be diſ-joyn'd. I ſuſpect the *Lyſiamachia Lutea* has an *Unicapſular Fruit*, and therefore it ought to be inſerted immediately before, or immediately after *Anagallis Lutea*, and *Nummularia*; for though they differ in the *Facies Externa*, yet with *Tournefort*, I do reckon them to be near of Kin to each other.

3. The *Tricapſulares*, though they ſhould agree in the *Fructification*, as it is plain they do not, yet its no ſmall Task to place their Subaltern *Genera* aright, ſo as to make them agree in the *Flower*, *Leaf*, and *Root*. *Hypericum* has a *Tricapſular Fruit*, but *Androſemum*

droſemum Maximum Wheeleri, is *Pentacapſular*, though none will disjoin it from its *Congeners*, only *Tournefort* makes it immediately to follow them, by the Name of *Acyrum*. I ſuſpect *Chameciſtus* is *Unicapſular*, *Pyrola Quadricapſular*, *Gramen Parnaſſi* is *Unicapſular*; as alſo *Viola Indica*, or *Cardamindum*, has three *Capſulæ* indeed, but they are *Disjunctæ*, and as it were in *Capitulum Congeſtæ*; neither is it *Seminibus Pluribus*, for every *Capſula* has but one *Seed*. *Aſarum* has an *Apetalous Flower*, and is *Hexacapſular*; ſo that there is none which agree with the Title in this Claſs, except *Campanula* and *Convolvulus*, and theſe not always neither; for the Fruit of the *Campanula*, as *Tournefort* obſerves, is ſometimes divided into *three*, and ſometimes into more *Pouches*; and likewiſe the *Convolvulus* is ſometimes *Unicapſular*, and ſometimes *Tricapſular*.

The *Tricapſulares Tricoccæ*, *viz.* the *Ricinus* and *Tithymals*, anſwer the Title well enough; but why the *Quadricapſulares*, &c. and the *Leguminoſæ*, ſhould interpoſe betwixt theſe and the other *Tricapſular* Fruits, I do not underſtand: but ſince they make up a whole Claſs of Flowers, called *Flores Liliacei*, I ſhall examine them when I come to *Tournefort's Method*.

4. *Quadricapſulares*. I am ſenſible *Ruta* has ſometimes a *Pentapetalous Flower*, but whether *Strammonia*, which has a *Monopetalous*

nopetalous Flower, does vary in the Number of the *Loculamenta*, I have not obſerv'd.

5. *Gerania* have indeed, for the moſt, a *Pentacapſular* and *Pentacoccous* Fruit; yet it's not the Number, but the Form of the *Capſulæ Caudatæ*, that make the *Genus* here. I think the *Ketmia* ſhould have follow'd the *Malva*'s, becauſe of the ſame Flower; and that the Number of the *Capſulæ* in the *Ketmia* is indefinite, and not always the ſame; neither is the Number always the ſame in the *Ciſtus* nor *Balſamina*, nor is it to be claſs'd with the *Trifolium Acetoſum*, upon any other account than the Elaſticity of the *Pod*; and at that rate, *Cucumer agreſtis* might be join'd with it alſo, which is a quite different *Genus*.

Laſtly, Among the *Multicapſular Plants* we ſhall own, that *Ariſtolochia* and *Nymphæa* is ſo, but neither can *Papaver*, *Argemone*, nor *Linum*, be join'd with any of theſe, for they are plainly *Unicapſular*, having ſeveral *Placentæ* or *Lamellæ*, which disjoin the *Seeds*, but which do not unite at the Center, ſo as to make up different *Loculamenta* or *Pouches*.

1. The next that follow are the *Plantæ Siliquoſæ*. And firſt for the *Multiſiliquæ*. The *Seda*, *Cotylidon*, *Telephium*, *Pæonia*, *Helleborus*, *Caltha paluſtris*, and *Pſeudo-Helleborus Niger*, *Flore Globoſo*, or *Ranunculus Globoſus*, may be all join'd together, becauſe

becauſe of the Figure of the *Flower*, but then *Aconitum*, *Aquilegia*, *Conſolida Regalis*, ſhould make up another *ſubaltern Genus*, becauſe their Flowers differ from the former: To which may be added *Nigella*, becauſe its Fruit, if not *Multiſiliquous*, yet is *Multicapſular*.

The *Siliquoſæ*, *Unicapſulares*, *Bivalves*, which follow next, ſuch as *Chelidonium majus*, *Papaver*, *Corniculatum*, as they are not *Papavers* becauſe they are *Siliquoſæ*, ſo they may be very well join'd with the *Tetrapetalæ Siliquoſæ*, notwithſtanding of the *Perianthium Bifolium Fugax*, *Raphaniſtrum*, *Hypecoon*, *Epimedium*, *Fumaria Sempervirens*, may be admitted here by the *Fructification*, though they differ very much by the *Flower*.

The *Siliquoſæ Univalves*, ſuch as *Gelſminum Indicum*, or *Bignonia* of *Tournefort*, and *Clematis daphnoides*, differ very much in the *Flower*; *Apocinum*, *Periploca*, and *Aſclepias*, reſemble each other, though the Species of the *Apocina* do not agree among themſelves in the *Fructification*, except as to their being *Pappeſcent* as well as *Lacteſcent*.

The *Siliquoſæ Quadrivalves*; as *Lyſimachia Siliquoſa Chamenerion dicta*, and *Corniculata*, differ from each other, becauſe the one is *Pappeſcent*, and the other not.

The

The *Regular Tetrapetalæ Siliquoſæ*, agree ſo well together by the common Conſent of all Authors, that it is, as it were, difficult to claſs them amiſs; and yet the *Raphanus Ruſticanus*, is plac'd among the *Plantæ Siliquoſæ*, whereas it ſhould have been plac'd next to *Cochlearia*, for its plainly a *Planta Siliculoſa*, though I ſhall not, with *Tournefort*, make it a *Cochlearia*, becauſe they differ ſo much in the *Facies externa*.

The *Tetrapetalæ Siliculoſæ*, differ ſo far in the Faſhion of the *Pod* from each other, that their only Characteriſtick is rather in the Bigneſs than in the Figure. The hot pungent Taſte peculiar to this Claſs of Plants, is a good enough diſtinctive Note, eſpecially in ſuch of them as are Water Plants, but there are ſome of the *Siliculoſæ* that are not pungent, as in the *Burſa paſtoris*, for that reaſon called *Thlaſpi fatuum*, by Mr. *Ray*.

The next Tribe of the *Tetrapetalæ Siliquoſæ*, called *Papylonaceæ*, or *Leguminoſæ*, are eaſily diſtinguiſhable by their Taſte, (called by Sir *John Floyer*, the *Pea Bloom Taſte*) from all other kinds of Plants; ſo that its eaſy to claſs them together, though their diſtinctive *Notes* are not ſo very obvious; ſo that it is ſometimes difficult to know which is a *Vicia*, an *Orobus*, *&c.* The *Lathyri* are eaſily decernible by the peculiar Figure of the Stalk; but there is no diſtinguiſhing the *Medica's* from the other *Trifoils* but by the Fruit,

which is also the surest *Note* to know how to distinguish each particular Species of the same *Genus*.

I know not, as I said before, why these *Tricapsular* Plants which follow the *Leguminosæ*, were disjoin'd from those formerly treated of. *Tournefort* calls these here *Lilliaceous Flowers*. I shall leave all these class'd together by him, and consider the *Genera* which follow such, as *Cyclamen*, *Orchis*, *Helleborine*, *Orobanche* and *Ophris*; as all of them differ much in the Flower, so they cannot be class'd here by their *Tricapsular Fruit*, that being for the most part *Unicapsular*, and opening at the top by one, two or three *Holes*.

All the *Bacciferæ* agree together, in so far as they bear *Berries*, but they differ so much otherwise, that they can never be regularly class'd together, *v.g. Rubus*, both in *Flower* and *Fruit*, differs from all the other, its *Flower* being *Polypetalous*, and its *Fruit Aggregate*, it comes nearer to the *Fragraria* than any, only that the one is *Herbaceous*, and the other *Fruticosus* or *Shrubby*: It would likewise resemble the *Morus* in the *Fruit*, if the *Morus* had not *Apetalous Flowers distinct* from the Fruit. *Smilax* and *Bryonia Alba*, are *Bacciferæ Scandentes*, and near of Kin to the *Pomiferæ Scandentes*, both in the Structure of the *Flower*, and Manner of the *Fructification*, and only differing from those in that Tribe by the Smallness of the *Flower*

Flower and *Fruit*. If any ſhall claſs *Chriſtophoriana*, *Laurus Alexandrina*, *Lilium Convallium* and *Polygonatum* together, *per me licebit*; but methinks *Aſparagus* comes but ill in betwixt theſe and the *Solana*; I ſhould rather have choſen to have plac'd it firſt, becauſe all the others have an undivided Leaf; or make it laſt of all, that all the *undivided Leaves* had been plac'd together, without the *intervention* of one whoſe *Leaf* is ſo deeply divided as the *Aſparagus*; for though there be ſuch a Diſproportion among all theſe Plants, that they agree in nothing, ſave their being *Bacciferous*; ſo that its no matter which go before or which follow: Yet there are ſome kind of Decorum to be obſerv'd, even in the very placing of them; ſo that to place a *fine compound Leaf* amidſt ſo many *ſimple ones*, would ſeem *incongruous*, unleſs by the Agreement of the other *Notes*, ſuch as the *Flower*, *&c.* it were neceſſary to do ſo: *v. g.* Suppoſing all theſe *Bacciferæ* to be planted ſucceſſively in a *Bed*, and *Lilium Convallium* on the one hand, and *Alkekengi* on the other of *Aſparagus*, none could think they were claſs'd together on purpoſe, before they had occaſion to obſerve the Fruit. The like Regard ſhould be had to the *Facies* of all Plants, in the diſpoſing them in a Garden, provided there be no Irregularity introduc'd in the *Characteriſticks* by ſo doing.

The

The *Pomiferæ Scandentes*, such as *Cucumbers*, *Pompions* and *Melons*, are a very distinct Class. For the *Ficus Indica*, *Cereus* and *Ficoides*, it is not long since there were many Species of them here in *Europe*; but now that they have encreas'd to be a numerous Tribe, known by the general Name of *Succulent Plants*, they may be very well describ'd into several *Genera*, and dispos'd near to those with whom they agree in *Characters*, *v. g.* some to *Aloes*, some to *Seda*, some to *Tithymals*, some to *Asphodels*, and some have been plac'd along with the *Starwort* Plants; most of the *Ficoides* have some Resemblance to a *Radiate*, and sometimes to *Semiflosculous Flowers*. I wish the *ingenious* Mr. *Bradly* would continue in publishing the Figures of these *Succulent Plants*, as they are brought home, since they can be so lively express'd in Copper Plates, and since there is no Possibility of preserving dry Specimens of them.

The *last Class* is the *Herbæ Flore Stamineo*, *seu apetalo*, *Pimpinella Sanguisorba*, *Plantago* and *Amaranthus*, are deservedly remov'd from among these by Dr. *Tournefort*. To these are added the *Herbæ Juliferæ*, as *Calamus Aromaticus*, *Equisetum*. In *Clavem Dispositæ*, as *Typha*; *Aspergillum imitantes*, as *Sparganium*. After them do succeed the *Capillares*, or *Epiphyllospermæ*; and next to these the *Frumenta* and *Gramina*.

The

The Trees are clafs'd after the fame manner with thofe of Mr. *Ray*, as the *Coniferæ*, *Refiniferæ & non Refiniferæ*, *Nuciferæ*, *Glandiferæ*, *Bacciferæ*, *Lanigeræ*, *Vafculis Foliaceis*, as *Ulmus*, *Acinis Coagmentatis*, as *Morus*.

The next Clafs is the *Pomiferæ*, *Umbilicatæ*, *Polypyrenæ*, *Bacciferæ Polypyrenæ*, as *Rofa*, *Groffularia*, *Vitis*, *Myrtus*, *Vitis Idæa*: But as all the other have *Succulent Berries*, I know not how the *Rofa* comes in here. *Dipyrenæ*, *Monopyrenæ*, *Pomiferæ non Umbilicatæ*, *Polypyrenæ*, *Malus Aurant. &c. Pruniferæ*, as *Malus Armeniaca*, *prunus Cerafus*, *&c.* Then follow the *Bacciferæ Variæ*, as *Monopyrenæ*, *&c. Arbores Fructu Sicco*, *Monococco*, *Tricapfulari*, *Monofpermo*, *Membranaceo Foliaceo Alato Seminibus Lanuginofis*; and laft of all the *Arbores Siliquofæ*.

Thus I have briefly clafs'd the Trees, according to the Fructification in Mr. *Ray* and *Herman*, for *Morifon*'s Difpofition of Trees was never publifhed.

Thefe are the Three, whofe chief Defign was to clafs the Plants by the Fructification, which though none of them have fo clofely adher'd to that Method as they might, yet they have fet it on fuch a Footing, as with a very little Labour and Pains, by a few *mutatis mutandis*, it may be brought up to a good Perfection.

Dr. *Moriſon*'s Buſineſs was to reduce the ſeveral Species into their proper *Genera*; and a great and laborious Work it was, conſidering how few Precedents he had before him. Mr. *Ray*, in his *Methodus Emendata*, has aſſign'd very handſome *Characteriſticks* to each *Genus*: In which he had no ſmall Aſſiſtance from *Rivini* and *Tournefort*; and he would have ſeem'd more *Methodical*, if he had not taken in too many Parts of the Plant to his Aſſiſtance; and Dr. *Herman*'s firſt Deſign ſeems to have been to rectify Dr. *Moriſon*'s *Method*, but he has done it ſo, as rather to make up a new *Method* than to correct an *old* one; it has a greater Regard to the *Fruit* than the other two, but it does not want its own Incoherencies and Inconſiſtencies, as has been ſhewn.

Rivini's *Method*. I conſider in the next place ſuch Methods as claſs the Plants by the Flower, and uſually diſtinguiſh them by the Fruit; *D. Auguſtus Quirini Rivini*, *Profeſſor of Natural Hiſtory* at *Leypſick*, is the firſt who thought upon this way of doing. He, obſerving that the Flower is the moſt *conſpicuous Part* of the *Plant*, and as it always appears before the *Fruit*, ſo it is the firſt Token we receive, that ſuch a *Plant* is of ſuch a *Genus*; and being allur'd by their Beauty, was tempted to take their Figures and engrave them, where obſerving what correſpondence

respondence there is betwixt the *Flowers* of the *same Tribe*, he doubted not, but by ranking them together, he could dispose of them into a very regular and orderly Method, and make their *Genus* be known before it could be discern'd by the Fruit. His Figures are elegant and fine, and the Specimens are drawn in their natural Bigness, by which if he should perfect the whole Method, it would be a large and expensive Undertaking. But as it is too much for a private Pocket to bear, and as there will be few to purchase Books of *Botany* of so large a Price, I'm afraid he will be oblig'd to give over his Design before it be half finished.

He classes the Flowers, 1. According to their *Figure*, in which respect they are either *Flore Regulari*, or *Irregulari*. 2. In respect of the Number of their *Petala*. Thus they are *Flore Monopetalo*, *Tetrapetalo*, *Pentapetalo*, and *Hexapetalo*, each in a separate Volume, whereof the first three are published, but the fourth has not come abroad yet, by what I can understand. As it is difficult to class so many Plants as there are now known under so few General Heads, so by this Method several Inconsistencies of separating must needs follow, such as the establishing of certain *Notes* for *Characteristick*, which are not always to be had in the same *Genus*, and perhaps not in the same Species. Some Species of the *Valeriana*, which is first of his *Monopetalous*

petalous Clafs of Irregular Flowers, have the Flowers divided into equal, and fome into unequal Segments; and fome of them are *Calcari donati*, like the *Delphinium*, and fome not: Shall either of thefe, which thus vary in the feveral Species, be accepted of as a *Characteriftick Note*, to conftitute the whole *Genus? Valerianella* alfo in feveral Plants of the fame Species, has Flowers with fome equal and fome unequal Segments, for all which it is not to be feparated from its *Congener Valeriana:* For as *Jungius*, *Ray*, and *Knaut*, (of whom hereafter) define a *Regular Flower* to be that, whofe *Petala* or *Segments* do not fo much agree in the Bignefs, as in the Figure and Situation, fo *Rivini*, in his *Introduct.* in *Rem Herb.* will have the other *Qualification* too, *viz.* that the *Petala* and *Segments* muft alfo agree in the Bignefs, that the *Stylus* be in the Center of the *Flower*, and that the Number of the *Stamina* be proportionable to the Divifions, or the Number of the *Petala*; as alfo that the *Calix* or *Perianthium* be *Regular*; fo that it is moft eafy to determine concerning the *Irregularity* of *Flowers*, according to *Rivini*'s *Definition*; infomuch, that if there be the leaft fwerving from this Rule of determining of *Regular Flowers*, then it muft needs be *irregular:* By which means he muft needs expofe himfelf to great Inconveniencies in determining of the *Flowers*, *v. g* In what inextricable Difficulties does he involve himfelf,

ſelf, about the *Gerania*, *Pyrola*, *Tithymals*, *Seda Bicornia*, *Malva*, *Alcæa* and *Lyſimachia*, among the *Siliquoſæ*; whereof ſome Species have a *Regular*, and others an *Irregular Flower*? And if the *Seda Bicornia*, as *Tournefort* has rightly diſtinguiſh'd them, are to be divided into *Saxifraga*, which is exactly *Regular*, and *Geum* whoſe Flowers are not always *Regular*, becauſe they have ſometimes an *Hiatus* on one ſide, and have not the *Stylus* in the middle; as alſo the *Petala* in the upper Part are bended outward, and in the lower they are bended inward, or are concave, by which they make an unequal Surface; ſo that theſe *ſubaltern Genera*, according to *him*, cannot be well join'd to the principal *Genera* of the ſame Claſs; the *Stylus* of the *Alcæa Vulgaris*, is not plac'd exactly in the middle, ſhall it therefore be ſeparated from the *Malva*, of which every one knows it to be a *ſubaltern Genus*? Moſt of the *Europæan Gerania* have a *Regular Flower*; but the others, eſpecially the *African Gerania*, have an *Irregular Flower*. This is obſerv'd by *Rivini* himſelf, and he ſeems to diſtinguiſh them by their *principal Genera*; therefore he calls the one *Geranium*, and the other *Gruinalis*. He reckons theſe *Gerania* which chiefly agree in the *Fruit*; for he ſays, the *Gerania* have *Semina Nuda*, but the *Gruinalis* has *Semina Vaſculis incluſa*. I ſhall not diſpute that with him, though it be the com-

mon Opinion, that all the *Gerania* have *Vascular* Seeds, *Geranium Cicutæ fol.* has almost *Regular Flowers*, has the *Semina Caudata*, and yet in *Rivini*'s Sense, they are to be look'd upon as having *Irregular Flowers* and *Naked Seeds*. *Geranium Robertianum* has *Regular Flowers*, and not *Semina Caudata*, upon which account they are rather *Naked Seeds* than the other: So that it ought not to be a Species of *Gruinalis*, according to *Rivini*'s Maxime. *Geranium Fol. Malvæ*, and *Columbinum*, seem in any respect to have *Regular Flowers*; and according to the Sentiments of *Ray*, *Herman* and *Tournefort*, they have the *Vascula Rostrata*, *Pentacocca*, so that they ought not to be separated from the other *Gerania*. The *Pyrolas* are join'd with the *Irregular Flowers*, and a *Vascular Fruit*, and yet by the excellent Figures he gives of them, they are all *Regular*, having nothing of *Irregularity* about them but the *Stylus*, which he compares to the *Proboscis*, though in some Species it is streight and short, as in the *Pyrola Arbutifol.* The *Tithymals* have their *Petala Regular*; and although the Weight of the *Tricoccous Fructûs Rudimentum*, which hangs about the middle of the *Stylus*, makes it to incline to one side, yet the part of the *Stylus* which is stretch'd forth without the middle of the Embryo, is regularly plac'd, being usually divided into three Parts in the Center. *Lysimachiæ*, *Siliquosæ*, *Chamene-*

Chamenerion dicta Species, are by him among the *Irreglar Flowers*, though there be nothing of *Irregularity* about them, only that the *Long Stylus* hangs on one ſide, before its Extremity is ſpread forth into four *Segments*; but after that, generally ſpeaking, it keeps the Center; and whether it be ſpread forth or nor, it always ariſes from the middle of the Pod, being ſurrounded by the ſeveral *Stamina*, which forming an Arch in the bottom of the *Flower*, make up an empty Space for receiving the *Farina*, as we ſhall obſerve hereafter.

Lychnis Sylveſtris, Quæ been Album Vulgo, has *Irregular Flowers*; and yet moſt of the Flowers of the other *Lychnis's* have their *Flowers Regular*. *Campanula Africana, Erini Facie Flore Violaceo, Cauliculis Procumbentibus, Herm.* has *Irregular Flowers*, and yet all the other *Campanula*'s are *Regular*. And if we ſtrictly obſerve *Rivini*'s *Rules*, what can we certainly determine concerning the *Flowers*, *Ulmaria, Belladona, Solanum, Nicotiana, Lyſimachia, Salicaria* and *Erica*, kinds of *Opulus*. In the *Umbelliferous Claſs* ſome have *Regular Flowers*, and others *Irregular*, as in *Spondylium* and *Coriandrum*. The *Verticillate* Kind are for the moſt part *Irregular*, yet the *Flowers* of ſome *Species* of *Mentha*, and both the Species of the *Pulegium* (for which they are join'd to the *Mentha*) and *Lycopus* or *Marrubium Paluſtre, Glabrum*, have their Flow-

ers Regular; insomuch, as *Tournefort* says of them, speaking of the two *Lips*, *Sic tamen ambo secantur ut flos quadripartitus primo aspectu videatur:* [a] And of *Lycopus* he says, that it is *Flore Monopetalo sed labiato & quodammodo campaniformi; labium enim superius vix distingui potest à partibus inferioris, adeo ut primo aspectu flos quadripartitus videatur.* [b] That is, "It has a Lip, and "almost Bell-flower, for the upper Lip is "scarce to be distinguish'd from the lower; so "that at the first View it seems to be divi- "ded into four equal Parts." And yet none will separate these two from their *Congeners*. And again, *Echium* has plainly an *Irregular Flower*, and yet none will justly separate it from its *Congeners*, *Borrago* and *Buglossum*, when they consider by its rough alternate *Leaves*, and all the *Facies externa* of this *Genus*, it can never be join'd to the *Verticillate* or *Lip-flower'd* Plants, notwithstanding it has four Seeds succeeding to each *Flower*, in common with the others of that Class; and if this Distinction of the *Regular* and *Irregular Flowers* be strictly observ'd, what shall become of the *Flores Corymbiferi Compositi Discoides* and *Semiflosculosi*, of *Tournefort*, where some of the *Flosculi* and *Semiflosculi* have the Borders divided into *equal Segments*, and others not? And where the *Capillamentum* of some is in the Center of the *Flower*, and

[a] Tournef. Instit. p. 188. [b] Ibid. 190.

others

others not certainly, this would create a great Confuſion, and make the ſeveral Species of the the ſame *Genus* to be ſeparated from it upon every trivial Occaſion.

The next part of this *Method* depends upon the *Number* of the *Petala*. If this be had any great regard to, what an Uncertainty would it introduce in ſeveral *Genera* of *Plants*, already determin'd by the common Conſent of all *Authors*, *v. g.* In the *Papylonaceous Flowers*, they are generally look'd upon to be *Tetrapetalous*, conſiſting of two *Alæ*, or Wings, like thoſe of a *Butter-flye*. The *Vexillum* ſpread forth aloft, and the *Carina*, making up the lower part of the *Flower*, in Shape like the fore-part of a ſmall *Boat*; for theſe *Flowers* are ſo ſmall in ſome *Species*, as in the *Lagopus* and *Melilotus Minima*, that their Number can ſcarce be determin'd; and where the *Flower* is large enough, ſome of them are *Pentapetalous*, with the *Vexillum* divided into two other *Monopetalous*, as *Trifolium Vulgare & Montanum Purpureum*; and if the *Trifolium Pratenſe Album* be ſtrictly examin'd, it will be found to be *Dipetalous*; nor has the Number of the *Petala* in the ſmall flower'd *Medica's*, been yet determin'd: I ſuſpect moſt of them will be found *Tripetalous*, and ſo in ſeveral ſmall *papylonaceous Flowers*, as *Ornithopodium*, &c. Let any conſider what *Tournefort* advances concerning theſe *Trifoils*, as alſo concerning the

Limonium

Limonium [a]. He places it among the *Polypetalous Claſs*, and among the *Flores Caryophyllæi* [b], and yet in the fore-cited Place, he ſays he found two *Species* of *Limonium*, with *Monopetalous Flowers*, viz. *Limonium Hiſpanicum fruteſcens portulacæ Marinæ fol.* and *Limonium Hiſpan. multifido fol.* but he did not think fit to ſeparate them from their *Congeners*; and he is in the right, not to determine the Number of the *Petala* in the *Ranunculus*, *Pulſatilla*, *Clematis*, and the like. *Tormentilla* has for the moſt part four *Petala*, but I have often ſeen it vary into five; and ſhall it be ſeparated from the *Pentaphyllous Claſs*, purely becauſe of the Number of its *Petala*? The Number of the *Petala* in *Balſalmina*, is uncertain, and ſome of the *Fumaria's* have *Bipetalous*, others *Tetrapetalous Flowers*. Many other Examples could be produc'd to prove the Inſtability of this *Method*, either in reſpect of the *Regularity* of the *Flower*, or Number of the *Petala*; but I ſhall leave them at preſent, ſince I ſhall have occaſion hereafter to ſpeak of this Subject, when I come to *Tournefort's* and *Knaut's Methods*.

Volkhamer's Method.

The next *Method*, which in order of Time was publiſh'd, was *Volkhamer's*, in his *Flora*

[a] Iſagog. in Rem Herb. p. 62. [b] P. 342.

Nurembur-

Nuremburgenſis. He's a learned and modeſt Author, and what he advances is with great Judgment; he has not made any *Methodical* Diſpoſition of the *Plants*, but treats of them *Alphabetically*; upon his entring into any new *Genus* in the *Catalogue*, he gives the *Characteriſticks* of *Moriſon*, *Ammannus*, *Ray*, *Herman*, and *Rivini*, in ſo far as his *Method* was then publiſh'd. He at laſt gives his own *Generical* and *Specifical Notes*, when he begins with the *Seed*, after that the *Seed-Veſſel*; from thence he conſiders the *Flower*, and then goes on with the *Stalk*, *Leaf*, and other leſs eſſential Parts of the *external Habit* of the *Plant*. He ſeems more inclin'd to claſs the *Plants* according to the *Fructification*, than the *Flower*, and is a very ſtrict Examiner of the *Seed*, which he rather inclines to make the *Characteriſtick Note*, than the *Seed-Veſſel* or *Fruit*; and although, as I ſaid, he do's not diſpoſe the *Plants* into any *Method* himſelf, yet by what Account he gives of the *Seeds*, *Seed-Veſſels*, and *Flowers*, he has trode out a very good Path for ſuch as have a mind to *methodiſe Plants* after him.

Tournefort's Method.

The noted and celebrated Dr. *Pitton Tournefort*, Fellow of the *Royal Academy of Sciences*, and *Botanick Profeſſor of the Royal Garden at* Paris, is the next, who according to the Series of Years, undertook to eſtabliſh a *new Method*. He was one who had an early

early *Genius* for the Knowledge of the *Vegetables*, and when his Parents design'd him for other Studies, nothing could withdraw him from enquiring after the *Plants*: His great Assiduity, and serious Application towards the Science of *Botany*, soon advanc'd him beyond the reach of the ordinary Set of Herborisers, nor was it long e'er his Fame reach'd the Ears of the *French* Court; and happy was it for that *delightful Science*, that Monsieur *Fagon*, one of the chief Physicians to the *French King*, had such a Taste of *Botany*, as to be capable to judge of, and to encourage such as had made any considerable Advancements therein. This made him seek after *Tournefort*, when *Tournefort* scarce had Time to seek after him, and to raise him to the *Highest* Pitch of Preferment the *Cultivators* of that Science are capable of: How great is the Advantage which the *Liberal Arts* and *Sciences* reap, when they who are deservedly distinguish'd for their Knowledge in them, are encouraged, and receive suitable Rewards from Princes, Potentates, and other great Men upon the Earth? And how much do these fade, languish, and decay, when the Cultivaters and Improvers of them, instead of being encouraged, are undervalued and set at nought every where? Nor did Dr. *Tournefort* prove unworthy of so great a Station; he with the utmost Earnestness prosecuted those considerable Discoveries and Improvements he formerly had

had made in the ocular Inſpection of the *Plants*, by which he added a great many particular Obſervations to thoſe of other *Botanick Authors*. The firſt thing he publiſh'd, or was publiſh'd in his Name, was the *Schola Botanica*, and being oblig'd to read *Botanick* Lectures in the Royal Garden, during the *Summer*-Seaſon, he began to rank or claſs them according to the Similitude and *Affinity* of the *Flowers*, they being the firſt and chief conſpicuous Parts of the *Plants*; and thus, by placing and diſplacing them from one Seaſon to another, he at length thought he had brought them to a ſuitable Conformity: Upon which, after making Application to his Patron Dr. *Fagon*, he was encourag'd to take the Figures of the *Flowers* he had obſerv'd, and to diſpoſe of them as he thought fit; nor did his Curioſity ſtop at the *Flowers* alone, he alſo takes notice of the proper *Fruit*, *Seed* and *Seed-Veſſel*, belonging or ſucceeding to each particular *Flower*; and thus compos'd his *Elementes Botaniques*, where if he had not been earneſt to diſpoſe of the *Plants* after ſo ſingular a manner; and had he us'd greater Endeavours to conform himſelf to the Diſpoſitions of others in ſeveral Caſes, he had done more for the Advantage of *Botany*, than by following his own Scheme ſo cloſely as he did; for there are ſeveral Inconſiſtencies in his *Method*, not only in his imaginary Claſſes, and unheard of Figures of the *Flowers*,

ers, but also in the Disposition of them, by making those which have no Resemblance succeed to each other; and it had consisted more with his Reputation, if he had made some Alterations, of which he could not but be sensible they were necessary when he publish'd his *Institutiones Rei Herbariæ*; but the Plates were engraven, they could not be alter'd without undoing most of what he formerly had done, and the *Method* was already established, which he knew not well how to change, without bringing the Students of his *Elementes Botaniques* into Confusion; therefore he was oblig'd to let it go on as it was begun, and let his Successors do with it what they had a mind. The fourth *Botanick Treatise* he wrote, was his *Histoire des Plants aux environ de Paris*, in which he has shewn a great deal of clear and judicious Knowledge of *Plants*. His Criticisms are true and just: The Mistakes of ancient Authors in the Figures and Descriptions, are modestly and impartially corrected. His own Descriptions of the *Plants*, when he gives any, are clean, neat, and distinct, nor can there be any thing done with greater Exactness. The Virtues of the Medicinal *Plants* are consonant to long and known Experience; and as to the *Analysis*, he every where gives that upon the Authority of the other Members of the *Royal Academy*, who it seems have registred all the Chymical Experiments made upon the *Plants*.

His

His Corollary is the effect of the three Years Voyage he made to the *Levant*, at the *French* King's Charges, where he has added 1100 different, new, formerly unknown Species, and constituted several new *Genera*. These are all the Writings publish'd by that great Man during his Life, besides those most valuable Volumes of his Voyages, which have been published since his Death, and which 'tis probable might have come abroad with far greater Advantages had he liv'd to perfect them.

Tournefort, as is usual by all those who establish any new *Method* in their *Præludia*, *Præcognoscenda*, *&c.* begins with an *Isagoge*, wherein he enumerates the several *Botanick Authors*, and shews the *Origine* and *Progress* of that *Science* throughout all Ages. Then he proceeds to explain the several Parts of the *Plants*; after which he goes on in laying down the several Rules whereby to constitute a *Method*.

He says, that all the Parts of a *Plant* are not to be admitted, in order to an exact Distribution of the *Plants* into a *Method*; but a certain Number, which cannot amount to five; such as the *Root*, *Leaves*, *Stalks*, *Flowers* and *Seed*. For so many together would rather tend to the Destruction, than better Establishment of any certain *Genus*; therefore the Generical Parts of a *Plant* are only to be pick'd out among some of them, four is too many; for then 'tis to be suspected that an

Affinity

Affinity would rather be wanting than found, both in the *Species* hitherto known, and those to be found out. Neither are the Generical Notes to be taken from one part of the *Plant*, such as the *Leaves*, for then there would arise a great Confusion among those which have simple *Leaves*, *v. g.* whether they be smooth or rough; how they are plac'd, whether upon the whole *Stalk*, or at the bottom; whether alternately, or by Pairs, and what a Disorder would *Plants* be brought into, if all these which have a divided *Leaf* were join'd together.

Nor 2, is the *Characteristick* to be taken from the *Flower* alone, for then would the *Cucumbers*, *Melons*, *Pompions*, be join'd with the *Campanula's*, and *Convolvulus*, &c. which would be far out of the Road. Neither 3, can the *Seed* do it, for then would all the *Verticillate Plants*, *viz. Mentha*, *Melissa*, *Marrubium*, *&c.* make up but one *Genus*, *&c.*

Having therefore considered each single part of the *Plant*, he is of Opinion it must require two or three at most of these Parts to be join'd together by different ways for setting aside the *Stalk*. The *Roots* may be join'd either with the *Leaves*, or the *Flowers* with the *Fruit*. The *Leaves* may be join'd with the *Flowers* or with the *Fruit*; and lastly, the *Flowers* may be join'd with the *Fruit*, for the Conjunction of the *Root* with the *Leaves*, and

and without any other part, can be of no use; nor can the *Root*, either with the *Flower* or with the *Fruit*, and therefore the true *Method* of constituting the *Genera*, must be by the *Flower* and *Fruit* together: He therefore lays down these three general Positions.

1. That there should be an exact *Method* in the Denomination of *Plants*, lest there be as great an Abundance of Names of *Plants*, as there are of the *Plants* themselves, which must needs happen, if every one take the Freedom to impose a new Name upon every *Plant*.

2 That all the *Plants* having the same *Facies Externa*, are not to be reckoned as belonging to the same *Class*, *v. g.* The *Herba Trinitatis Fuchsis*, is a *Viola*, though it have not the *Leaves* of a *Viola*. A *Mallow* can never be a *Betony*, though there be some *Mallows* with *Betony Leaves*. How many *Plants* are there which come from *Africa* with the *Leaves* of *Malva*, *Alchymilla*, *Myrrhis*, *Coriandrum*, which when they push out the *Flower*, and begin to frame the *Fruit*, shew themselves to be *Gerania*.

3. We should be oblig'd to impose new Names upon *Plants*, different from what our Predecessors had given them, if there were only regard had to the *Root* and *Stalk* for constituting the *Genera*. Thus the *Ranunculi Aconiti*, *Plantaginis*, *Graminis Fol.* &c. would be no more *Ranunculi*, if no regard is to be had to the *Flower* and *Fruit*.

Therefore the following Rules are obſerv'd by him, not as perpetual, becauſe ſome Allowance muſt be given to Uſe, and the ſeveral Opinions of *Botaniſts*; but ſuch as he, is not inclin'd to depart from but very ſeldom, and that for very weighty Reaſons.

1. That the *Plants*, which have neither a conſpicuous *Flower* or *Fruit*, are to be diſtributed according to their other principal Parts, as well as if they had both.

2. A particular Regard is to be had to both *Flower* and *Fruit*, in the Diſtribution of ſuch *Plants* as have them, ſince both Nature and Cuſtom directs us to them.

3. We muſt adhere to the *Flower* and *Fruit* together, ſince they are fully ſufficient to conſtitute the *Genera*.

4. Not only all the other Parts of the *Plants*, but alſo whatever elſe belongs to them, ſuch as *Taſte*, *Smell*, *manner* of *growing*, may be call'd in for Aſſiſtance, when the *Flower* and *Fruit* are not able rightly to diſtinguiſh the true *Genera*.

5. In order to throw out what may be ſuperfluous, Enquiry is to be made whether ſuch a *Genus* would be chang'd by ſo doing; for as nothing ſhould be added to the *Flower* and *Fruit*, unleſs the *Genus* cannot be diſtinguiſh'd otherwiſe, ſo other Parts may be admitted if Occaſion require it, *v. g.* *Populus* differs only from the *Salix* by the *Facies Externa*, and *Fœniculum* from its *Congeners*, by the

the fine Diviſion of the *Leaves*, and *Helianthemum* from *Telephium*, by the *Leaves* ariſing in Pairs from the Joints of the *Stalk*.

6. The *Etymology* of the Names of *Plants* is not to be regarded, *v. g.* *Chamædrys* is ſo call'd from the Reſemblance they thought one *Species* of it had to the *Oak*, for the Word imports a dwarf *Oak*, from χαμαὶ & δρῦς, as if it ſhould be call'd *Quercus Humilis*; but this do's not hinder the *Scordium*, and *Scordio Affinis*, or *Salvia Sylveſtris* to be a Species of it, for this laſt *Plant* cannot be a *Salvia*, becauſe it has not the ſame *Flower* and *Fruit*; neither would it at this rate be a *Chamædrys*, becauſe it has not an *Oak Leaf*.

Tournefort is averſe from admitting of the *Summa Genera*, and *Subaltern* ones; but I am not of his Opinion; for the diſpoſing of *Plants* ſo, is a great Aſſiſtance to make a clear Diſtinction of them in ſome Caſes, *v. g.* *Malva*, *Malva Arborea*, *Althæa*, *Alcæa*, are all of the *Malvaceous Kind*, and yet no Perſon will ſay they are the very ſame *Genus*; but if *Malva* be admitted to be the *Summum Genus*, then *Althæa*, *Alcæa*, &c. may very well be accepted of as *Subaltern Genera*. If *Pentaphyllum* be receiv'd as a *Summum Genus*, then *Tormentilla*, *Argentina*, *Pentaphyllum Paluſtre*, are *Subaltern Genera*; for none of theſe can be called *Species* of the *Pentaphyllum*. If *Ranunculus* be a *Summum Genus*, how many *Subaltern Genera* belong to

it? *Anemone, Chelidonium Minus, Hepatica Nobilis*, becauſe of its relation to the *Chelidonium*; all theſe in the *Flower* and *Fruit*, are *Ranunculi*, and yet they are *Subaltern Genera*, moſt of them having ſeveral *Species* belonging to them. How many *Subaltern Genera* do there belong to the *Geranium*, as *Batrachoides*, *Columbinum*, *Robertianum*, and ſeveral others, all which have their ſeparate *Species*? However, this Liberty is not to be abus'd, for there may be an Error, in multiplying either the *Genera* or the *Species*, as well as in making too few of them.

The Science of *Botany* is ſo very extenſive, *Plants* may be ſo variouſly *diſtributed*, *Non deſcripts* which are daily brought from Abroad, are ſo numerous, and their *Characters* are ſo often different from the *Europæan Genera*, that there is enough to do with all the Diviſions, and *Sub-diviſions* which can be invented, in order to bring them into a *regular Diſpoſition*, and therefore that *Quadruple Diſtinction* of *Tournefort*'s into *Claſs*, *Section*, *Genera*, and *Species*, ſeems to be one of its greateſt Advantages, and preferable to that of *Genus primum*, *ſecundum*, *&c.* and after them the *Subaltern Genera*. For according to *Tournefort*'s *Method*, *Malva* becomes the *Section* of a *Claſs*. *Althæa*, *Alcæa*, *&c.* are ſeveral *Genera* of this *Section*, yet ſtill there is need for another Diviſion, *viz.* The four firſt *Genera* are, *Flore & Fructu Malvæ*, and they are diſtinguiſhable

able by the *Calix*, or *Perianthium*, as ſhall be ſhewn hereafter; but there are four more *Genera*, which though they agree in the *Flower* with the *Malva*, yet they differ in the *Fruit*. Now if theſe cannot be rightly diſtributed for want of proper *Subdiviſions*, when they are already branch'd out into four, how much more are *Subdiviſions* neceſſary, when they are only divided into *Genera*, where the Number infers no Dependence upon one another?

To *Claſs* a *Plant* then, is to fix upon one particular part of the *Plant*, by which all kind of Vegetables, where ſuch a part is to be had, is to be denominated, *v. g.* If the *Flower* is the part pitch'd upon, by which the *Plants* are to be claſs'd, then all the *Claſſes* throughout the whole *Method*, are to be *denominated* by the ſeveral *Flowers*. If the *Fruit* be the *Character*, then all the *Claſſes* are to receive their *General Title* from the *Fruit*, and ſo of the *Seed*, &c. This to me ſeems the readieſt way to avoid the Confuſion of *claſſing* by ſeveral other Parts of the *Plant* in the ſame *Method*. I ſhall not determine whether the *claſſing* by the *Flower*, or by the *Fruit*, be moſt conſiſtent with the *Leges Naturæ*; but the *claſſing* by one part of a *Plant*, rather than by many, ſeems to be the more Uniform of the two, if the *Nature* of the thing will bear it.

Our *Author*, *Tournefort*, prefers the *Flower* to the *Fruit*, or any other part of the *Plant*, and his Reaſons for it are, That as his *Method* has the Advantage of all others, by being ſimple, it can immediately lead one to the Knowledge of the Name of a *Plant*, for having found the *Claſs*, the Knowledge of the *Genus* is ſoon found out, and that being known, the Deſcription of a *Species*, formerly unknown, will be eaſily learnt, and a *Non deſcript* can eaſily be reduc'd to its proper *Genus*: This is the ſhorteſt way to arrive at the Knowledge of *Plants*——But if there be a regard had ſometimes to the *Leaves*, *Flowers*, *Stalks*, and *Roots*, whereto ſhall he who is ignorant of any *Plant*, have his Recourſe? It is plain therefore, that the *Claſſes* of *Plants* ought only to have one *Foundation*, and That, ought to be one of the Parts by which the *Genera* of all the *Plants* are to be conſtituted, in the which the *Flower* ought to be prefer'd to the *Fruit*; for at the Examination of the Structure of the *Flower*, one may immediately, or within a few Days, come to the perfect Knowledge of the *Fruit*; yea, by the tranſverſe cutting of the *Piſtillum* or *Calix*, the Nature of the *Fruits* is eaſily known to thoſe who are exercis'd in that way of doing; after which the Character of the whole *Genus* may be found out in a more ſuccinct manner——But if the *Fruit* be requiſite for conſtituting a *Claſs*, the next Seaſon another

ther must be waited for, before the other part of the *Character* of the *Genus*, to wit, the *Flower* (which after the *Fruit* is ripe, withered and dry'd up) can be found out.

Therefore, in the constituting of a *Class*, the *Flower* alone must be us'd as the *Key* and *Foundation* of *Botany*, in such *Plants* as have a *Flower*. In constituting of the *Genera*, the *Flower*, together with the *Fruit*, is requir'd; and in constituting of the *Species*, several other of the Parts may be admitted.

Being come to the *Method* it self, he first divides or distinguishes the *Plants* according to their Structure, in which respect they are either *Herbaceous*, or *Ligneous*. But whereas they are commonly distinguish'd into the *Arbores Frutices*, and *Suffrutices* which make up the *Ligneous*, and *Herbæ*, which make up the *Herbaceous* Part, he only chuses to use a two-fold, instead of the former four-fold *Distinction*, so that the *Herbæ* and the *Suffrutices*, and the *Frutices* and *Arbores* go together, not because he is not sensible that the *Suffrutices* have a *Ligneous* Substance, and a perennial Surface (for most of the *Suffrutices* are Evergreens) and are even *Gemmiparæ* in their woody Part, as much as the *Shrubs* and *Trees* are; but because of their low Stature and short Duration, and because to rank them separately would create a Disturbance in that Symmetry and good Order in one of the most fix'd *Classes* in all the *Botanicks*, for who would separate

Rosmarinus, *Lavendula*, *Hyssopus*, *Thymus*, from *Majorana*, *Mentha*, *Melissa*, without greatly dismembring of that Tribe; and who would be at Pains to separate *Abrotanum Mas*, from *Absynthium*, if there were no more in't than that the one has a woody, and the other an *Herbaceous*, *Medullary Stalk*?

2. In respect to their Flowerings. Thus the *Herbs* are divided into such as have conspicuous *Flowers*, and such as has have them not; or into the *Floriferous* and *Non-floriferous Plants*. The *Floriferous Plants* are, either *Monopetalous*, *Polypetalous*, or *Apetalous*. The *Non-floriferous* are such as have no *Flower*; but as the *Capillares* have a *Seed-Vessel* and *Seed*, and such as have neither *Flower* nor *Seed*, as the *Musci*, *Fuci*, *Fungi*.

The *Trees* are divided into five *Classes*, viz. *Flore Apetalo*, *Amentaceo*, *Monopetalo*, *Rosaceo*, *Papylonaceo*, so that in few Lines you have the Distribution of all the *Plantarum Genera* expos'd to View.

When he comes to the *Classing* of the *Plants*, he disposes of them according to such Shapes and *Figures* as are imagined by himself. But as the *Plants* themselves will not admit of such Distributions without a great many Inconsistencies, so he has been expos'd to the Censure of several *Authors*, since his *Institutiones* have been published upon that account; and so much the more, in that he puts so great a Value upon his own *Method*.

So that I ſuſpect what he accuſes Dr. *Moriſon* of, will more truly be applicable to himſelf, "*Summis laudibus excipendus, longè vero* "*majoribus ſi à ſuis abſtinuiſſet*;" for that he was *ſui Plenus* upon his Performance (or as Mr *Ray* ſays reproachfully of Dr. *Moriſon*, *Cum ſibi nimis placeret*) is too evident from his own Words; *Mihi non parum Gratulor cui omnium poſtremo neſcio quo bono fato contigit demonſtraſſe hanc Methodum, cæteris omnibus præſtare & ſingulis Generibus ita aptâſſe ut magno Herbariorum commodo futurum ſperare audeo.*

But leaving this, I proceed to the more particular Examination of his Claſſes.

Claſs 1. *Flores Companiformes.* Theſe he divides into two Kinds: 1. If the *Bottom* and *Sides* are large, then 'tis a *Bell-flower* ſimply, as in the *Campanula.* 2. If the Bottom and Sides are contracted, then it is *Tubulous*, as in the Flowers of *Polygonatum Cerinthe:* But, 3. If the Borders are larger than the Bottom, then it is *Pateus*, as in *Malva* 4. *Globulous*, as in the *Arbutus*, *Ruſcus*, *Erica*, *&c.* Notwithſtanding of all theſe Diſtinctions, yet the Flowers in this Claſs will not bear the Teſt; neither has he been ſo very lucky in his Diſtribution by them, though they ſhould bear: *e.g. Mandragora* has no Affinity with *Bella dona*, for the Flowers of the *Mandragora* are deeply divided, almoſt to the Bottom, the other only

only divided ſuperficially at the Borders; and *Mandragora* is rather *Pomiferous* than *Bacciferous*; *Bella dona* has an high branched Stalk; *Mandragora* has no Stalk, but its Flowers ariſe by ſeveral Pedicles from the Root, and has much larger *Leaves* than the other, and no wiſe like them. *Lilium Convallium*, *Polygonatum*, and *Ruſcus*, are all three *Bacciferous* indeed, but they have no Relation by any other *Character*, except that there may be a ſmall Reſemblance in the Texture and Faſhion, not Bigneſs and Diſpoſition, of the Leaf, in the firſt two. *Sect.* 3.

The Plants here neither agree in the *Flower* nor *Fruit*, which are his two eſſential *Characters* never to be abſent; for ſome of them are *Flore Tubulato*, as *Cerinthe*; ſome *Campaniformes*, *Tubulati & Patentes*, as *Gentiana*; ſome are *Unicapſular*, *Bicapſular*, *Multicapſular*; and then as to the *Plantæ Habitus*, ſcarce one *Genus* agrees with another; and there ſhould ſtill be ſome Regard had to that, in order to make a *Method* conſiſtent. *Tithymallus*, *Glaux*, *Maritima* and *Oxys*, have no Coherence, and can never regularly ſucceed to each other in one Section. 'Tis juſtly doubted if *Oxys* be *Monopetalous*; and for the *Rhabarbarum* in *Sect.* 4. it has all the *Characters* with the *Lappatha*, to which it more properly belongs. *Apocynum* and *Aſclepias* are indeed of kin, but they have little to do with *Cotylidon* for a Neighbour.

The

The *Malvaceous Tribe* will not eaſily disjoin, though the *Flora Batava* does it in the *Ketmia*, as has been obſerv'd. The *Pomiferæ* and *Bacciferæ Scandentes*, come as well in here as elſewhere, nor will they eaſily ſeparate; but I know not how *Campanula* and *Rapunculus* come to ſucceed next to them; nor how the *Rubia's* or *Stellatæ* can be ſaid to have a *Bell-flower*; I ſhould rather think they belong to the *Flores Rotati*, by the Faſhion of the *Flower*. They agree in nothing ſo much as in the Diſpoſition of the *Leaves*; for *Rubia Tinctorum* is a *Baccifera* Plant, though the Berries only contain two Seeds. *Aparine* and *Aſperula* differ from each other by the Diſpoſition of the Flower; for *Aſperula* has its Flowers *Umbellatim Diſpoſitos*; both of them have two *Capſular* Seeds ſucceeding, and therefore may be juſtly called *Gymno-Diſpermæ*; but for the *Aparine Supina, Flore Cæruleo, Tournef. Rubia Parva, Fl. Cæruleoſos Spargens, J. B. Rubeola Arvenſis Repens Cærulea, C. B.* **Dillenius* having ſtrictly examin'd it, makes it a *Planta ſui Generis*, and therefore makes a Preſent of its Name to Dr. *Sherard*, calling it *Sherardia*. The Account he gives of it is, "that by its Flowers it agrees with the *Ru*-"*beola*, (what *Rubeola* he means different

* Dillen Nova Plant. Genera, p. 96. Edit. Francofurt. 1719.

"from

" from this I know not) but different in " the Figure and Disposition of the Seed; " for its *Flowers Embryoni gemello insiden-* " *tes*, are *Funnel* like, or *Infundibuliformes*, *Tubulo nempe ut in Rubeola Longi-* " *ori donati, nudi & Tetrapetaloides*, as the " rest of that Class; but the *Seeds* are *aculea-* " *ta singulanempe tribus aculeis prædita*, so " that to each pair of *Seeds* there appear six " *aculei*. The *Flowers* and *Seeds* are ga- " thered in *Capitula multis ad basin foliis* " *radiatim ut in Asseriseo Tournefort cincta*. " These *Capitula* of *Flowers* arise from the " top of the Stalk and Branches; and there " are for the most part to be observ'd eight " Leaves in these, in which are contain'd six, " seven or nine Pair of Seeds. The Seeds " are firmly united when green, but separa- " rating when ripe, convex or turgid on the " out side, and flat on the inside where " join'd with the Partner. The Seeds are na- " ked, as in the rest of this Class, (although " *J. Bauhinus* says, they are *vasculous*, to " whose Opinion *Knautius* and *Ruppius* also " consent) for the Bark or *Vasculum* adheres " very firmly to the Kernel or Seed, and " there is no inner Cavity betwixt them. It " does not agree to the above-nam'd *Syno-* " *nyma*, for by its Seed it differs from the " *Rubeola*, with which *Ruppius* thinks it a- " grees; for *Rubeola* has *Semina levia Re-* " *niformia*, and therefore it cannot be ascrib'd

" to

" to it, far leſs to the *Rubia*, with *J. B.* or " *Aparine* with *Tournefort*, which has round " rough Seeds, when theſe are rather ob- " long, but prickly at the top, not to ſpeak " of the Difference of the *Flower*, being ob- " long, *tubulous* and narrow; and that theſe " upon the top of the Branches and Pe- " dicles, *(è foliorum alis egreſſis)* are heap'd " up in a *Corymbiferous* Manner in a plain " Head, *multis foliis radiatum cinctis*. He " ſays he has only obſerv'd one Species of " this Plant, which is mentioned in the tenth " Page of his Appendix †. Now the Plant " he mentions there is the *Rubia Parvo " Flore Cæruleo ſe Spargens*, *J. B.* which " himſelf ſays is quite different from this. " However, I have given the Figure of it as " from him ‡, and ſhall look upon it as *Plan- " ta ſui Generis*, until another Seaſon al- " low me to examine the *Rubia* or *Rubeola* " of *Bauhinus*." The celebrated Dr. *Sherard* is oblig'd to him for this deſerved Teſtimony of his Eſteem; but as Mr. *Vaillant* has made the like Preſent to the Doctor already, of a kind of *Verbena Americana*; and an *Italian Botaniſt* has inſcrib'd a third Plant to him. This Exceſs of *Civility* towards the Patrons and Correſpondents, may turn to a bad Account to the *Botany*, by an unneceſſary Mul-

† Dillen. Append. ad Plant. Circa Gillam. p. 10.
‡ Tab.

tiplication

tiplication of Names, or giving the same Denomination to Plants of so very different Tribes. The only way I see such an Inconveniency can be prevented, is by adding the Giver's Name to the Gift, such as *Sherardia Valentii*, and *Sherardia Dillenii*, &c.

But to return to *Tournefort*. He joins the *Gallium Palustre Album* to the *Cruciata*, because it has only four Leaves at a Joint; but since it has the same Flower, dispos'd after the same Manner, and since it agrees in nothing with the *Cruciata* but the Number of the Leaves, (for the *Cruciata* has *Flores magis Sparsos è Foliorum alis*) it should rather be continued with the other *Gallia Alba*, and *Mollugines Montanæ*, for without that he does Violence to his own Method, by robbing it of a just Regard to the Flower and Fruit, in putting such a value upon the Number and Disposition of the Leaf.

Class 2. In the first *Sect.* of the *Flores, Infundibuliformes*, I think *Centaurium minus*, as I have formerly observ'd, should have been plac'd next to *Gentiana*, or *Gentiana* next to it; for if *Gentianella* were made a separate *Genus*, (in the doing of which there would be no great Inconsistency) I should not scruple to call *Centaurium minus*, *Gentianella Autumnalis, Foliis angustioribus, Flore magis Patente*. I have not indeed examin'd, whether it be *Bicapsular* or *Unicapsular*, with the others of this *Sect.* However

Quamoclit

Quamoclit may be ſaid to have a *Flos infundibuliformis*, and upon that account ſeparate from its *Congener Convolvuli*. I know not but *Menianthes S. Trifol. Paludoſ. Nicotiana*, *Hyoſcyamus*, might as well have been reckoned among the *Flores Campaniformes*, as brought in here; and they ſeem to be ſo odly join'd in with *Stramonium*, *Auricula Urſi*, and *Pervinca*, three Plants which have no kind of Reſemblance to each other, either in Flower or Fruit. Can there be any greater difference than a *groſs Quadricapſular long Siliquæ*, and a *ſmall Globular Fruit*? I ſhould think the Flower of *Auricula Urſi* deſerves as well to be among the *Fl. Hypercrateriformes*, as *Androſace* and *Primula Veris*; and for *Plantago*, were it not that he has laid down for a general Rule, that the *Petala* of a Flower never become the *Capſula* of a Fruit. This with the Brethren *Coronopus* and *Pſyllium*, might have gone along with the *Flores Apetali ſive muſcoſi*, by the outward Appearance; but there is ſomewhat to be ſaid, becauſe of their *Conical Capſular* Fruit opening tranſverſely, which never happens to thoſe which have *Apetalous* Flowers. That's a ſtrange Conjunction betwixt *Jallapa Rubeola ſpicata* and *Valeriana*. The Flower of the *Jallapa*, or *Mirabilis Peruviana*, ſeems to me to reſemble that of a *Convolvulus* more than any. The fourth *Sect.* contains thoſe, otherwiſe called *Aſperifoliæ*,

which though they do not all resemble each other by the Flower, yet by the four Seeds succeeding, by the alternate rough Leaf by which they are distinguished from the *Plantæ Flore Labiato*, and by the whole *Facies externa*, they cannot be well separated. Dr. *Knaut* would have *Echium* carried off, because it has somewhat of a Lip Flower, but that cannot be done without Violence, (*sans tort*) as the *French* say; for it would be a Stranger among them, as not being cloath'd in the same Fashion, whereas 'tis a Domestick, having the same Livery with these. *Nummularia* and *Anagallis Lutea*, cannot be conveniently brought into the same Family with the *Lysimachia Lutea*, but they may be admitted as Neighbours, and *Anagallis Lutea* may very well dwell with *Nummularia*; all the three love to possess the same shady Soil. I have brought *Pyrola Alsines* into the Family of *Anagallis*, since it was not formerly known to whom it belong'd; and although I have nam'd it *Pyrola Unicapsularis* in my *Miscellaneous Observations*, lest it should be mistaken for want of its former Name; yet I may very justly call it *Anagallis erecta unicaulis*, and I describe it thus; *It's a small Plant, not rising above two or three Inches high, unless nourish'd carefully in a Garden, with its Mother, black, mossy, fat Earth, for then it will ascend five, six, or seven Inches, with a stronger Stalk, and much*

much larger Leaves. It has a small, running, white, knobby and *fibrous Root, from whence arises a small, streight, naked Stalk, till it come to the top, when it is loaded with several dark-green pointed Leaves of different Bigness, some half Inch, others quarter Inch broad at the Base, and about one Inch, or one Inch and half, long; thick set, surrounding the Stalk: From the middle of these arises a very fine small* Pedicle, *bearing a small, deeply divided and pointed Flower, like unto the* Anagallis, *to which succeeds one* Spherical Capsula, *or Seed Vessel, opening transversly, and containing several small Seeds fix'd to a* Placenta *in the middle. Sometimes I have seen it bear two Flowers, each supported by a proper* Pedicle, *arising from the top of the Stalk amidst the Leaves. That which is peculiar to this Plant is, that the Leaves are never of the same Bigness, but some larger and others less. Samolus Valerandi* is justly separated from the *Anagallis*, and *Veronica sive Anagallis aquat.* though it more resembles the latter than the former. *Tournefort* every where acknowledges Dr. *Morison* to have been the Author of the Distribution of the *Anagallides aquaticæ*, some of the *Alsine*'s, and *Chamædrys Sylv.* among the *Veronica's*, which Mr. *Ray* does not, as has been observ'd. *Verbascum* and *Blattaria* are near of kin; but one would think *Chrysosplenium* or *Saxifraga Aurea*, and *Polemonium*,

nium, or *Valeriana Græca*, had no Relation to them. For the *Sect.* 7. of the *Bacciferæ*, I have not yet seen any Distribution where these Plants have been so class'd together, as to agree in their less Essentials, such as the *Plantæ Habitus*; but *Cyclamen* seems to be a Stranger here. *Pimpinella Sanguisorba* is by some class'd among the *Flores Muscosi*, along with the *Plantago*; because neither of them have so conspicuous *Flowers*, as at the first view they may seem to be *Petalous*; but *Sub judice Lis.*

Class 3. The *Anomalous Flowers* are *Anomalous* indeed; for there is a strange *Miscellany* of different *Genera* of *Plants* huddled up here: *Arum* and his Brethren, *Dracuntium* and *Arisarum* are Friends; but what relation has *Aristolochia* with *Rapuntium Galeatum*, or *Digitalis* with *Bignonia*, the one having a *Conical Capsula*, and the other a *Long Siliqua?* Indeed these two have some resemblance in the *Flower*, and perhaps might have been brought in with the *Flores Campaniformes*, or *Infundibuliformes*, but neither of them agree with *Scrophularia*, and far less *Scrophularia* with *Pinguicula*. This last would have come better in with *Linaria*, in the fourth *Sect.* and *Linaria* should not have interpos'd betwixt *Antihirrinum* and *Asarina*; neither should *Melampyrum* have come in betwixt *Pedicularis* and *Euphrasia*. *Acanthus* is well plac'd by it self; nor

nor does it come in unfitly among the *Anomalous Flowers*.

Claſs 4. Is a Sett of Plants agreeing ſo well together, that they cannot well be miſplac'd, if any will be at tolerable Pains to obſerve the Flowers; but I think it would have been no loſs to *Tournefort*'s Method, that he had ſome Conſideration to the Leaf in the General Character of the Claſs, eſpecially ſince there is another Sect of Plants which have the ſame Fructification with theſe, *i. e.* four Seeds, and ſometimes in a *Tubulous Calix* too; where would have been the Harm to ſay, that moſt of theſe Plants have leſs Leaves than the other; that they have a ſmoother Surface than the other; that they are frequently odoriferous, often fruteſcent or ligneous, there being ſeveral *Suffrutices* belonging to this Claſs; and have always their Leaves ariſing by Pairs from the Stalk? Theſe, and ſuch like, leſs eſſential or diſtinctive Notes, would preſerve them from being incumbered with Strangers, even though there were no regard to the *Spicate* and *Verticillate Diſpoſition* of the Flowers; for otherwiſe how can *Echium* and other *Lip-flower'd Plants*, (which may yet be found) with alternate rough Leaves, be kept out. I think that's but a frivolous Objection which ſome make, concerning the Equality in the Segments in the *Mentha*, *Pulegium*, and *Marrubiaſtrum*, but I am not clear that *Pulegium* ſhould be

adopted among the *Menthæ*. There is a *jene ſcais quoy*, as the *French* call it, ſomewhat peculiar to each, which ſeparates them, though they may well live together as Neighbours. The other objection againſt ſeveral of this Claſs, that they have not always four Seeds, I think is likewiſe of no moment; for generally ſpeaking, they have the four *Embryones*, but the want of the Nouriſhment, or the Narrowneſs of the Bounds of the *Tubulous Calix*, may hinder them from coming all to Maturity; and ſeveral of them may fall off in the open *Husk*, before they come that Length. In ſome *Genus*'s, as *Verbena*; the Seeds are long and very ſmall, that they may be the better adapted to the Capacity of the *Calix*, which is erect, and lies cloſe to the Stalk to preſerve them from falling off before they be ripe. The Sect of the *Unilabiate Plants* is very diſtinct from the reſt: But *Scordium* and *Scorodonia*, or *Salvia Sylveſtris*, each of them deſerve to be plac'd ſeparately, though in the Neighbourhood of the *Chamædrys*, as well as *Calamintha* and *Hedera Terreſtris* among the *Bilabiatæ*, may live near to one another, but not in the ſame Family.

Claſs 5. Is conſiſtent enough in ſeveral of the Sections, and agreeable to the Diſtribution of moſt other Authors. *Sect.* 1. has an unuſual Title; that its *Genera* are *Capſular*, not *Siliquous*, though it makes good what I have advanc'd, *Eſſay* 2. " That there may be a

" *Capſula*

" *Capsula* which is not a *Siliqua*, but most of the *Siliquæ* may be call'd *Capsulæ*. All of this Section are *Monospermæ*, which likewise shews, that where there is but one Seed, that is not always naked, but frequently contain'd in a *Capsula*, as well as if there were severals. His changing of former Names, as *Rapistrum* for *Myagro Affinis*, *C. B. Myagrum* for *Myagrum Monospermon*, is ready to puzzle *Botanick Students*, and it is a Fault he's too often guilty of. *Sect.* 2 and 3. contain those Plants otherwise call'd *Plantæ Siliculosæ*; 'tis difficult to distinguish them from *Capsulæ*, but *invaluit usus*. I have already observ'd, that *Raphanus Rusticanus* may well be brought into the Neighbourhood, but will not allow the being admitted into the same *Genus* with the *Cochlearia*. *Sect.* 4. Contains the *Plantæ Flore Cruciformi*, or *Tetrapetalæ Siliquosæ*, *omnium Authorum*. *Raphanistrum Siliqua Articulata*, was formerly the *Rapistrum*. *Hypecoon* is rightly brought near to *Chelidonium Maj.* and it would not have been amiss that *Glaucium*, or *Papaver Corniculatum* had been brought hither also, notwithstanding the Largeness of the *Petala*. I know not how *Erucago*, *Potamogeiton*, and *Herba Paris* come hither. I expected to have met with *Potamogeiton* among the *Flores Apetali*, along with the *Persicaria*; and for *Herba Paris*, it should go somewhere among the *Bacciferæ*, and not among this Class of the *Te-*

trapetalæ, where none but *Siliquoſæ* and *Siliculoſæ*, or *Capſulatæ*, can regularly be admitted.

Claſs 6. Contains the Plants with a *Roſaceous Flower*. Here is ſuch a jumble of *Diſſimilar Plants*, or Plants of ſuch a Diverſity of *Genera*, no wiſe correſponding with each other, as can be found no where but among the Ancients, where nothing of Method was known, and therefore little regarded. The Diſpoſition of the *Flower* makes the *General Title*, with this Qualification, that the *Petala* be *in Orbem Poſita*, like to a *Roſe*; but how *Circæa*, which has but two *Petala*, *Ruta*, *Onagra*, *Chamænerion*, &c. can be ſaid to have *Petala in Orbem Poſita Roſis æmula*, I know not. *Sect.* 1. *Amaranthus*, if he will not have it to be an *Apetalous Flower*, as ſome do, it might have been join'd to the *Plantago*, for it may be look'd upon as *Monopetalous*, as well as the other; and they have the ſame Diſpoſition into a Spike; the ſame *tranſverſe opening Capſulæ*, and the ſame, or rather longer *Duration* of the *Flower*, as the other; *Portulaca* likewiſe ſeems rather to have a *Monopetalous*, than *Polypetalous Flower*. *Papaver* and *Opuntia* are vaſtly different, as alſo *Opuntia* differs much from *Granadilla*, *Murucuia*, and *Mitella*, and *Alſine* from theſe; how can *Parnaſſia* come in with *Juncus?* and for *Kali*, as Dr. *Preſtone* well obſerves, it cannot be ſaid to have

have *Petalous Flowers*, unleſs the ſmall *prickly*, *green Leaves* of the *Calix* be taken for ſuch. Should I go on with the reſt of this Section, to ſhew their Inconſiſtencies with one another, I ſhould enlarge more upon this Subject than is convenient for my preſent Purpoſe. *Sect.* 3. *Geum* is rightly ſeparated from *Sedum Bicorne*, or *Saxifraga Alba: Salicaria*, or *Lyſimachia Spicata*, is a different *Genus* from *Lyſimachia Lutea*, or *Chamenerion*, i. e. *Lyſimachia Siliquoſa*, and *Glaucium*, as is obſerv'd, may be plac'd elſe-where. *Sect.* 4. *Hypericon* being *Tricapſular*, the common *Androſemum*, called the *Berry-bearing* St. *John*'s-*wort*, is made a ſeparate *Genus*, as *Unicapſular*. And *Hypericon Montis Olymp. Wheel.* is ſeparated from it by the Name of *Aſcyrum*, becauſe it is *quinquecapſular*. The other *Androſema* and *Aſcyra*, are join'd with the *Hypericon*. *Sect.* 6. *Sedum* and *Anacampſeros*, are Neighbours good enough, but they ſeem not to be of Kin with *Ulmaria*, nor *Barba Capræ*. *Geranium*, is a large *Genus*; but if the Faſhion of the *Flower* is rightly conſidered, they ſhould be certainly divided into thoſe which are *Petalis Æqualibus*; and *Inæqualibus*, as is rightly obſerv'd by *Rivini*, though both have the ſame kind of *Capſular Fruit*. *Sect.* 7. *Anemone* is a *large Tribe*, and differs from the *Ranunculi* by the *large*, *oblong*, *downy Head*, and ſomewhat elſe peculiar to its *Facies*

Externa, which cannot be expreſs'd. *Tournefort* makes the *Anemone Nemorum* a *Ranunculus*, but I would chuſe with Dr. *Hotton*, in his Letter to Mr. *Ray*, to make it a ſeparate *Genus* from both the *Anemone* and *Ranunculus*, as partaking of both, and not wholly belonging to either; for it has a *ſingle*, naked, *ſolitary*, *Polypetalous Flower*, without a *Calix*, an undivided *Stalk*, ſtrictly ſurrounded by three Leaves, in all which it agrees with the *Anemone's*; but its Fruit, conſiſting of ſeveral naked *Seeds* (*in Capitulum Collecta*) is like to the *Ranunculus*. I think it may ſtill retain its former Name, rather than with Dr. *Hotton* to call it *Anemonoides*, *Anemone Ranunculus*, *Ranunculus Anemonoides*, or with Dr. *Tournefort*, to call it *Ranunculus Nemoroſus*, thereby to confound it with other Species having that Epithet. I have already obſerv'd, that the *Chelidonium Minus*, *Hepatica Nobilis*, *Adonis*, *Plantago Aquat.* however join'd with the numerous Family of the *Ranunculi*, yet th y have all ſomewhat peculiar to themſelves, which may ſtill make them be look'd upon as diſtinct *Genera*. The *Plantago Aquat.* being a *Tripetalous* Plant, is not enough to *ſwallow* it up among the *Ranunculi*; but it may very well have for a *Congener* the *Sagittaria*. *Fragraria* is not ill plac'd betwixt the *Caryophyllata* and *Pentaphyllum*, though it be *Bacciferous*; and if *Rubus* did not properly come in among the *Frutices*,

Frutices, it might be made a Neighbour to the *Fragraria*; as also *Chamærubus*, commonly *Chamæmorus*, which is a low, creeping Plant, for all of them have a *Fragraria*, *Flower*, and *Berry*. *Christophoriana* and *Asparagus* may be join'd together, because of their being *Bacciferous*, though otherwise they differ in the *Facies Externa*; but of this already, as also of *Circæa*, *Agrimonia*, and the rest of this *Sect*.

Class 7. The *Flores Rosacei*, and *Umbellati*, or otherwise the *Umbelliferous Plants*, are a Tribe which is now come to a good Consistency. As to the Distribution, Dr. *Morison* was the first who brought these to any regular Conformity; if he had let his *Umbelliferæ impropriè Dictæ* alone, for by bringing them in, he shew'd a greater regard to the *Plantæ Habitus*, than was consistent with the *Method* he propos'd, which was the *Fructification*: but *Herman*, who follows his Distribution, has omitted them. Mr. *Ray* has another Disposition of them in his *Methodus Emendata*, regular enough. *Tournefort* has added *Eryngium* and *Horocotyle* to *Sanicula*. Mr. *Ray* seems to accept of the *Eryngium* (though he gives its Notes elsewhere) but loves not to admit of the *Hydrocotyle*, leaving it to be among the *Aquaticæ incertæ Sedis*, though if several *Pentapetalous* Flowers *(in Capitulum Collecti)* to which succeed two Seeds, be a Note, he'll not get rid of it.

Class

Claſs 8. Of the *Plantæ Flore Caryophyllæo*, is a ſhort *Claſs*, but conſiſtent enough for the *Caryophyllus* and *Lychnis*; but *Linum* might have been among the *Flores Roſacei*, as properly as ſome others; as alſo the *Cucubalus*. And for the *Staticæ* or *Caryophyllus Montanus*, more properly *Maritimus*, for that's the Soil it affects moſt, I think it ſhould have rather been plac'd among the *Flores Compoſiti*, or *Floſculoſi*, near to the *Scabioſa*, both in reſpect of the Flower and Seed; and for *Limonium*, it might have come in among the *Monopetali Infundibuliformes*, but he has accounted for that already in his *Iſagoge*.

Claſs 9. The *Flores Liliacei*. This is a very perplex'd and confus'd *Claſs*, notwithſtanding which there ſeems to be ſomewhat inviting in them; and for enticeing of *Botaniſts* to bring them together into one *Claſs*, to conſider their Roots, moſt of them, are *bulbous* and *ſquamous*. Several *Geniculate*, others *knotted* and *fibrous*, not *ſquamous*; and others fibrous, not knotted; their Leaves are all ſimple, undivided, ariſing without Pedicles, chiefly from the Root, with a ſtrait Stalk in the middle, ſeldom branch'd but at the top, in order to carry the more *Flowers*, which ſometimes are more looſely diſpos'd, at other Times more compact; and *in Capitulum Collecti*. The Leaves are either long, flat, and broad (*Lanceiformia*) *Spear-like*, or *narrow Graminei-Folia*, or *Tubuloſa*,

loſa, hollow, as the *Cepa*. The *Stalks* are either *Nudi*, as in moſt of the *Genera*, or *Folioſi*, having ſeveral Leaves accompanying the Stalk, either *alternately*, or *Radiatim*, as in ſeveral of the *Lillies*; their *Fruit* is *Tricapſular*. In a word, their *whole Facies Externa*, requires them to be claſs'd all together; neither do they diſagree ſo much in any thing, as in that by which *Tournefort* is oblig'd to claſs them, *viz.* their Flower; for both by their Structure, Diſpoſition, and Number of their *Petala*, they differ moſt of any other part of the Plants, *v. g.* Some of them are large, as the *Lillies*, *Tulips*, *Flower-de-Luce*, *&c.* Others very ſmall, as *Allium*, *Cepa*, *porrum*, *&c.* moſt of them have equal Segments, or *Petala*, but ſome unequal, as the *Irides*, *Gladiolus*. Many of them are *Monopetalous*, divided into ſix Segments, as *Aſphodelus*, *Colchicum*, *Crocus*, *Narciſſus*, *Iris*, *Hyacinthus*, juſtly divided into three *Genera*, *Tubuloſus*, as *Hyacinthus propriè dictus Globoſus*, by the Name of *Muſcari*, and *Stellaris Ornithogalli Species*; ſome are *Tripetalous*, as *Ephemerum ſive Phalangium Virginianum*, and all the Remainder are *Hexapetalous*, ſo that he had good Reaſon to ſay, that he did not claſs them ſo much upon the account of their Flower, as their *Tricapſular* Fruit. However this may be made an Objection againſt his *Method*, I wiſh there were no greater Inconſiſtencies in it than this; for as there is no

altering

altering the determinate Rules of *Nature*, so it was better to bring all these together by some one essential *Character* (and the *Fruit* is not the least essential) than to suffer them to remain dispers'd, as they were before *Method* was so much in Request.

Class 10. Is so regular and determin'd, that the *Papylonaceous Flowers* cannot well be separated from each other; for besides their *irregular Flower*, (as *Rivini* expresses it) for the most part *Tetrapetalous*, and some *Bipetalous*, and *Tripetalous*, as has been observed, they have peculiarly belonging to them, that their Seed is always *Capsular*, or rather *Siliquous*; generally speaking they are *Scandent*, with an infirm Stalk; but sometimes it is otherwise, as in *Lupinus*. Their Leaves are either *Bina*, two *smooth Leaves* arising by Pairs from the Joints differently dispos'd from the *Verticillatæ*, *Terna*, *three Leaves* upon one *Pedicle*, as the *Trifoils*, *Quina*, five Leaves, as the *Lotus*'s, viz. three *larger*, and two *less*, or *Pinnata*, several arising by Pairs from a *Mid-rid*, as *vicia*, *Orobus*, ending in a *Clavicula* or *Climber*, or without a *Clavicula*, but having a *Folium impar extremum Claudente*, as *Gallega*; or lastly, *Digitata*, as *Lupinus*. In a word, by the *Facies Externa* 'tis very easie to distinguish a *Papylonaceous Plant*, from all others, even before either *Flower* or *Fruit* appear, especially by the *Taste*, which is peculiar to those of this Plant, being

being for the most part sweet, more or less conjoin'd, with a bitterish Taste, usually known by the Name of a *Pea-Bloom-Taste*, as Sir *John Floyer* has it. Its *Siliquæ* are sometimes *Monospermæ*, as the *Trefoils*, *Planæ*, and more or less *Tumidæ*, as the *Pisa*, *Fungosæ*, as the *Faba*, *Articulatæ*, as *Securidaca*, *Hedisarum*, *in Colcheæ formam convolutæ*, as *Medica*, *Cochleata*; *falcis in modum retorta*, as *Medica*, *Falcata*, &c. All these *Siliquæ* are *Bivalves*, opening from one end to the other, each Seed has a separate *Placenta*, for the most part dispos'd in Rows, frequently about the Number five, but sometimes extending to seven or eight, as in the *Pisa*, but very seldom nine, of a *Spherical Figure* in that *Genus*, but in most of the other *Reniformia*, and sometimes *Quadrata*, as in the *Fœnum Græcum*.

Class 11. Still shews the Inconveniencies which happen, upon the placing the Characteristick Note in one part of the Plant, particularly the Flower. For, 1. There is a Necessity of separating from the other Classes or *Genera*, what ever will not agree with such and such a Flower, which being different from that, and from all other Classes, where the Flowers are of such a determinate Shape and Disposition, must therefore be *Anomalous*. 2. By so doing these *irregular Flowers*, which could not be join'd with the *regular Classes*, must be taken from them, even though they might have

have otherwise agreed in the *Fruit*; so that they who might have made up a *regular Disposition* if *class'd* by the *Fruit*, must now be condemn'd to a perpetual *Irregularity*, both in *Flower* and *Fruit*, since it is not to be expected, any two *Genera* can agree throughout a whole *Class*; so that the Character of this *Class* is, that its *Regular* in nothing but in *Irregularity*, as it's said of some, that they are *Constant* in nothing but in *Inconstancy*: But if a *Regularity* is to be at all endeavoured, I should chuse to place *Cardamindum*, or *Nasturtium Indicum*, next to the *Viola*, and *Fumaria* before *Balsamina*, that it might have a View at a Distance of the *Papylonaceous Flowers*, to which it has some Resemblance: And *Luteola* might have been safely brought at least to the *Orchides*, since there is nothing in the Title of the *Sect* that could hinder it, *Flore Anomalo cujus Pistillum abit in Fructum*, being pretty general, and the *Flowers* of the *Luteola* are not unlike *Helleborine*, *Oprys*, *&c*

Class 12. *Herbæ Flore flosculoso*, is a large Class, and comprehends two or three *Genera* of Mr. *Ray*, besides others adjoin'd to it; as the *Corymbiferæ Nudæ*, *Capitatæ*, *&c*. besides other Plants *Tournefort* is pleas'd to join with it. *Sect*. 1. Contains the *Plantæ*, *Flore Flosculoso Sterili, sive à fructu remoto*, as *Xanthium*, *Ambrosia*, *Gnaphaloides*. To which may be added, (if *Dillenius*'s Observation hold good) *Gnaphalium*

Gnaphalium Montanum, Flore Rotundiore: for he says[g], "There appear to be two "Species of this Plant, yet they are not "different Species, but different Sexes, for "those which have longer, are *Female-* "*Flowers*, and they whose Flowers are roun- "der, are barren, or *Male-Flowers*, to "which either two Seeds succeed, or only "empty Husks". I confess, I have seen both *Species* often grow together, and was ready to distinguish the two Species into *Flores Nudi*, such as he says have *Male-flowers*, and *Flores Radiati*, such as he calls *Female*, or *Fertile Flowers*; but I am not certain, until a new Opportunity of observing it more narrowly do offer; if it is so, 'tis probable both may be from the same Root, and thus it may come in with this *Section*. And it is not unlikely, that what he says is true, for running Plants are not very fond of producing *Seed*, most of the Nourishment being spent upon the running Roots, and pushing forth of *new Shoots*; therefore those with the *Long* or *Fertile Flowers*, are by far the more rare. This Flower likewise varies into a reddish or Blush Flower, and into a pure White. *Sect.* 2. Contains most of the *Capitatæ*; the fourth has the *Corymbiferæ Nudæ*, as *Absynthium*, *&c.* of which we have treated already. In this *Sect.* is contain'd the *Bidens*, from the two

[g] Dillen. Cat. Plan. Circa Giessam. p. 60.

Spinulæ

Spinulæ of the Seeds; but Dr. *Sherard* from Mr. *Bobart* informs Mr. *Ray*, that this is an Error; for, says he, the Seeds of these Plants, (as of many of the other *Corymbiferæ*) have four *Spinulæ* each, though two of them generally, or in many Plants, fall off before they are ripe; in others only two remain. These *Spinulæ* are also observable in the *Semen Cardui Benedicti* by *Tournefort*, called *Cnicus*; and their Number is usually according to the *Striæ* in the Seed it self. He joins *Scabiosa* and *Dipsacus* together in one *Sect.* but *Knaut* is not of that mind, as shall be shewn.

Class 13. Treats of the *Herbæ Semifloscu-losæ*, call'd by Mr. *Ray*, and several others, *Natura plenè Lactescentes*, or *Pappescentes & Lactescentes*, or *Planipetalæ Lactescentes*; but as none of these touch the true *Character* of the *Class*, except that of *Planipetalæ*, I look upon *Tournefort*'s Title to be the best. These agree so well in their Characters, other Accidents and Virtues, that there is no separating of them almost, if one had a mind to do it; their *Genera* are distinct enough, but it is not easie to know each particular Species by its distinctive Note, *v. g.* In the *Hieracia*, *&c.* they are divided naturally enough into those *Seminibus Papposis* and *Non Papposis*. They have all an agreeable bitterish Taste, are cooling and refreshing, being good for Sallads, as *Lactuca*, *Sonchus*, *Endivia*, for blanching or Winter Sallads, as *dens Leonis*

nis, for Pickling or Pot Roots, as *Cichoreum*, *Scorsonera*, *Tragopogon*, &c.

Class 14. Containing the *Plantæ Flore Radiato*, comes next. These consist of the *Discoides*, *Seimne papposo* of Mr. *Ray*, making up the first *Sect.* as *Aster*, *Virga Aurea*, *Jacobæa*, &c. or *Corymbiferæ Radiatæ*, *Seminibus Solidis*, as *Calendula*; all of this *Class* answer their *Title*, and are easy to be distributed.

Class 15. The *Stamineous* or *Apetalous*, is a large *Class* of *Flowers*, but eaſy to be distinguish'd from all others; nor is it difficult to distinguish any of the *Genera* from their *Congeners*. The first *Sect.* indeed does not so well agree, for *Asarum* has no Resemblance to *Beta*; *Acetose* and *Luppatha* agree better; and I have observ'd, that *Rhabarbarum* might have reasonably join'd with them. *Atriplex* and *Chenopodium*, are deservedly made distinct *Genera*. There are great Mistakes concerning the *Herniaria*.

Dr. *Prestone* at *Edinbrugh*, that accurate *Botanist*, trusting too much to *Tournefort*'s Account of it, (as himself afterwards acknowledges) says, "it has a *Quadriphyllous Flower*, whose *Pistillum*, (in *Tournefort*'s Language) becomes a *membranous striated* "*Capsula*, divided into eight Pouches, like "to the *Linum Catharticum*, each containing a small *Semen Ovato-acuminatum*: For which *Dillenius* takes him smartly up, charg-

ing him with no leſs than Unskilfulneſs or Ignorance in *Botany* *; which is too ſevere, conſidering the ſmall Acquaintance he had of Dr. *Preſtone*'s Knowledge that way; and if he had read a Letter writ by the Doctor to Mr. *Ray* ſince that time, he would have retracted his former harſh Sentence, and would have found it is the ſame with his *Radiolus*, as he ſuſpects; for Dr. *Preſtone*'s Account of the *Herniaria*, in the forementioned Letter, publiſhed by Mr. *Derham*, among Mr. *Rays* Poſthumous Letters, is thus.

" I have been miſtaken, ſays he, in the for-
" mer Account I gave you of *Herniaria*, fol-
" lowing too much the Faith of Dr. *Tourne-*
" *fort*, not having examin'd it nicely enough
" my ſelf. Therefore what I have diſcover-
" ed ſince is as follows. *Herniaria Ger. J. B.*
" has a *Tetrapetalous* and *Herbaceous Flow-*
" *er*, whoſe *Piſtil* becomes a *Membranai-*
" *dous Carinulate*, or *Striat Capſule*, like
" the Fruit of the *Linum Catharticum*, divided
" into eight *Loculaments*, in each of which
" is contain'd one ſmall *Seed Ovato-acumina-*
" *tum*, beſides the four *Herbaceous Petala*,
" that are green without, and white within. It
" has alſo ſeveral *Stamina*, but thoſe *Petala*

* Cæterum videtur nobis *Preſtonum* loco allegato *Radiolæ Noſtræ* Characterem attribuiſſe & confudiſſe cum *Herniaria*, planta vulgaris notitiæ; quod de *peritiâ ejus Botanicâ magnum Teſtimonium dare non poteſt.* Dillen. Cat. Plant. Sponte circa Giſſam naſcent p. 88.

never

" never become the *Involucra Seminis*. This " is what I have found on repeated Obſervati- " ons. *Tournef. Inſtit. R. Herb.* places it *in- " ter Herbas Flore Stamineo cujus Piſtil- " lum abit in Semen Calice Obvolutum*. But this Plant cannot properly be called *Stamineous*, for the *Petala* or *Calix* never become the *Capſulæ*, or *Involucra ſeminis*; but they have a third *Membranaceous Capſula*, as above deſcrib'd. You have alſo (ſays he to Mr. *Ray*) given it a *Stamineous Flower*, conſiſting of four *Herbaceous Petala*, and plac'd it among the *Polygonums*; but whether it can be properly called *Stamineous*, I leave to you to determine.

Qu. If *Herniaria Ger. J. B. page* 69. *Synopſeos* be a diſtinct *Genus* from the *Millegrana Minima*, *Syn. page* 207. The laſt is plac'd amongſt the *Vaſculiferous* Plants, with a *Pentapetalous Flower*, but more particularly amongſt the *Alſines Species Anomalæ*, *Flore Tetrapetalo*. This Note ſeems to agree, even to the *Herniaria Ger. J. B.* in that it is *Vaſculiferous*, and has a *Tetrapetalous Flower*; ſo that they ſeem not to differ much in the *Flower*. The Reaſon of my Queſtion is, becauſe all thoſe I had opportunity to examine, both in *Ericetis*, in Lee Grounds and in Corn Fields, I could not obſerve any Difference in the Characteriſtick, only in the Growth. I ſhall not queſtion but there may be two diſtinct *Genus*'s under that Name, but

could not be satisfied of it by your Observation.

This is the very Plant which *Dillenius* is so afraid to be rob'd of its Discovery, that he has honoured it with a new Name, calling it *Radiola*, thus describ'd by him: "There is "a small Plant, which, because its *Capsulæ* "or *Vascular Pouches* are *Rotatim & Ra-* "*diatim Dispositæ*, we shall call *Radiola*. It has *Tetrapetalous*, *Rosaceous* Flowers, to which succeed Seed-Vessels, consisting of eight Pouches, which containing small, yellowish Seed; the Flowers and *Vascula* are both so small, that they must be observed by a Microscope.

Thus far these two accurate *Botanists*, concerning a Plant so very small, that it is never to be seen but when bearing Fruit; but since I have seen it for several Miles together, on the Sides and the middle of Highways, usually in the Prints of Horse Feet, which had been full of Water in the *Winter*, and is dry'd up in *Summer*. I shall give the following Account of it. *It has a small fibrous Root, and a small strait Stalk, not above the grossness of an ordinary small Pin when about an Inch high or more; when more luxuriant it sends forth one Pair of small, oblong Leaves, not above one Line long, and half a Line broad*; *and* è Foliorum Alis *arise two Branches, and these again are sub-divided into other two, and so on, always arising* è Fo-

è Foliorum Alis *to the top, which terminate in the above deſcribed* Flower *and* Seed-Veſſel. *I ſhall not determine whether the Flower is Petalous or not, but if ſo, then they are* Petala non Decidua, *for in as far as I could diſcover, it has either the* Petala *always accompanying the Seed Veſſel, or it has a Pair of* Foliola *at the Bottom.* I ſhall not ſay 'tis a true *Millegrana*, but I may ſafely reckon it, ſometimes *Centum Grana*, for it has ordinarily ſixteen or twenty *Branchings*, ſuppoſing the leaſt, *which is ſixteen, and that each* Seed-Veſſel *has eight Seeds: This makes one hundred twenty eight*; *and I may poſitively aver, that I have ſeen it have above thirty Branchings or Flowers, for its very buſhy, otherwiſe it would not be ſo perceptible by one on Horſeback: 'Tis the leaſt Plant with a regular Flower that perhaps is known, and is juſtly called all Seed.* The *Millegrana major* is truly a *Polygonum*, by a Specimen Dr. *Sherard* was pleas'd to ſhew me; but I am not ſo well acquainted with it as with the other, which it ſeems is rare in *France*, and I am told, not very frequent in *England* nor in *Germany*, which made *Dillenius* ſo fond of his *Radiola*. The Specimen which Dr. *Sherard* ſhew'd me, and which was of a pretty large ſize, was ſent to him from *France*, with a Quære, they being ignorant there what it was; ſo that 'tis no wonder if *Tournefort* has not deſcribed it: But enough concerning

ſo ſmall a Plant. I know not whether *Alchymilla* ſhall be reckoned *Apetalous*, but it has four upper ſmall pointed *Petala*, which ſeem to be ſupported by four ſmall under Leaves of the *Calix*, ſo that it muſt either be *Octophyllous*, or *Tetrapetalous*, and *Tetraphyllous*. Indeed, the *Herbaceous* Colour would ſeem to import its being *Apetalous*, though its of a more yellowiſh green, when it makes toward the Flower, than elſewhere, as the *Horminum Hortenſe*, when the *Spike* begins to make towards the *Flower*. I ſhould not have grudg'd the *Potamogeitons* a Place among the *Apetalous* Flowers, if Dr. *Tournefort*'s more nice Obſervation had not determin'd the contrary: So that *Perſicaria* ſhall have leave to remain here alone. I make no doubt of *Parietaria* being *Apetalous*, but it deſerves to have *Chenopodium* for its Neighbour, for I have ſeen ſome of its Species ſtretch forth the *Stamina*, and ſhed the Duſt, as it do's. *Polygonum* and *Biſtorta* would gladly be lookt upon as *Petalous Flowers*; for the Leaves of their *Calices* belie the *Petala* very much, being *colore inſignes*, eſpecially on the inſide. *Sect.* 3. Conſiſting of the *Frumenta* and *Gramina*, are ſo well eſtabliſh'd by the Reſemblance they have to each other, and by the common Conſent of all Authors, that I need not offer to make any Remarks upon them. The two following Sections, the one having *Male-Flowers*, and *Female-Embryones*

ones upon the same Plant, and the other having them in different Plants of the same Species, are consequential enough, only I think *Urtica* should have been join'd with the former, and not with the latter, for I have very often observ'd, That *Urtica Romana Pilulifera*, has the *Racemi* of *Male-Flowers* upon the same *Stalk*, and *Branches* with the *Pilulæ* of Seeds; and if so, I doubt not but it may be in other Species of the *Urtica*, after the same manner, (though I *ingenuously* acknowledge, I have not been at Pains to enquire) for Nature do's not use to vary in Things of such Consequence as the manner of *Fructification*. For *Equisetum* Mr. *Ray* observes, " That some of the Species of the " *Equisetum* seem to produce the *Fruit* or " *Flower* upon peculiar, naked Shoots or " *Surculi*, and distinct from the *leafy Stalk*, " before the other Stalks break forth. O- " thers are *Spicatim Digesti* upon the top of " the *leafy Stalk*, and therefore he reasona- " bly suspects the ingenious Dr. *Preston*'s Ob- " servation, That *Equisetum Sylvestre te-* " *nuissime Divisum* has round white Seeds, " like to those of some of the *Musci*, upon " a small Pedicle, half an Inch long (*Pla-* " *ne Capillaceo* ;) but Mr. *Ray* justly doubts " whether these may not be more properly " *Seed-Vessels*"; and I suspect they are rather *Apices* upon the top of fine *Stamina*; for as the use of the *Apices*, and their con-

taining of the *Farina Fœcundans*, was not well understood in his Time, he might very reasonably have mistaken the one for the other; for as Seed-Vessels or Seeds, are seldom upon the the top of a small Pedicle, without there had been a previous Flower, so there is nothing more ordinary among the Stamineous Flowers, than for the *Apices* to be upon the top of the *Stamina*, at some Distance from the *Stalk*, when the Seeds are lodg'd *in Foliorum Sinubus*, or upon the top of the Stalk, to be impregnated by the *Farina* blown in upon them by the Wind from the *Apices*, as *Tournefort* expresses it: *Fructus enim Speciei Equiseti innascuntur*, says he, *quæ Floribus carent, grana nempe Auctore Cæsalpino nigra aspera & farcta* ([b]). This is also to be observ'd in the *Kali Geniculatum*, whose Flower consists of several single *Stamina*, each loaded with an *Apex* sticking out, as in the *Gramina* when the Seeds are lodg'd among the *Genicula* themselves.

"*Dillenius* separates the *Hippuris*, as he "calls it, from the *Equisetum*, because it "wants the *Clavi* and *Surculi* of Flourishes; "and instead of these has small, solitary, and "dispers'd Grains (which he rather supposes "to be Flowering than Seminary, having no "Pedicles betwixt the *Folia* and *Setæ*; be-"sides that, the Stalks are not articulated *Pixi-*

[a] Raii. Emend. p. 20. [b] Instit. R. H. 532.

"*datim*,

datim, as in the *Equiſetum* [c]. I have added theſe Things, not from my own Obſervation, but from the fore-cited Authors, that I may perſuade the curious to pry more narrowly into the *Fructification* of this ſingular Plant.

The *Fructification* of the Plants in the two remaining Claſſes, *viz.* the *Capillares*, *Muſci*, and *Fungi*, *&c.* having been examin'd by ſeveral curious Authors already, and being more the Objects of *Microſcopical* Obſervations, than *Ocular Inſpection*, I have omitted them, becauſe they make nothing to my Purpoſe, ſince what I have propos'd to advance in this Treatiſe, may be obſerv'd by any Perſon with the naked Eye.

The *Shrubs* and *Trees* which are contain'd in the remaining Claſſes of this *Method*, as they can be more conveniently claſs'd by the *Flower* than the *Herbs*, ſo I ſhall inſiſt but little upon them, only that I ſhall give an account of their ſeveral Diſtributions, recommending the Examination of their *Fructification* to other curious Perſons; for any Obſervations I have made upon the Structure of the Flowers, they ſhall be contain'd in the next *Eſſay*.

Claſs 18. Contains the *Trees* with *Apetalous Flowers*. *Sect.* 1. Of thoſe whoſe *Flowers* are conjunct with the Fruit, as *Fraxinus*. *Sect* 2. Of ſuch *Trees* and *Shrubs* whoſe *A-*

[c] Dillen. Nova Plant. Genera. p. 88.

petalous

petalous Flowers are upon ſeparate Branches, from the Fruit upon the ſame Plant, as *Buxus*, *Erica Baccifera*. *Sect.* 3. Of the *Trees* and *Shrubs*, which have the *Flowers* ſeparated from the *Fruit* upon different Species of the ſame *Genus*.

Claſs 19. Treats of the *Juliferous*, *Nuciferous*, and *Coniferous Trees*, as *Nux Juglans*, *Corylus*, *Abies*, *Pinus*, *&c.*

Claſs 20. Contains the *Trees* with *Monopetalous Flowers*, which only has one *Genus*, whoſe Flowers are ſeparated from the Fruit, as the *Viſcum*, whereof ſeveral other *Species* than theſe to be ſeen in *Europe*, are known to the *Celebrated Dr.* Sherard, whoſe *Texture*, *Structure*, and *Chymical Analyſis*, has been moſt *nicely* and curiouſly examimed by the *diligent* and *accurate* Dr. *James Dowglaſs*, R. S. S.

Claſs 21. Contains the *Trees* and *Shrubs* with *Roſaceous Flowers*. Theſe anſwer in the Reſemblance of their Figure, better to that of the *Roſe* than the *Herbs*, though ſome of them are not fully ſo like it as were to be expected, in order to denominate a *Claſs*; but as he has once made this Diſtribution of them, and as ſeveral have followed his Example, they are not now to be chang'd without a new Confuſion in *Method*.

The laſt *Claſs* is that of the *Trees* with *Papylonaceous Flowers*; theſe are generally known by their Figures, whatever be the Number

Number of the *Petala*; and as their Fruit is always *Siliquous*, so he divides the several *Sections* according to their Leaves.

This being the second Method where the Plants are distributed according to the Flower, I proceed to the *Third*, which is that of *Christianus Knaut, M. D. Archiater Anhaltinus & Bibliothecarius Halensis.* This, as *Dillenius* observes, is a Mixture of *Rivini* and *Tournefort*'s Method, but as it wants not its own Defects no more than the others, so it do's not want its own good Qualifications, the Distribution of the Flowers being made as regular as the Nature of the Thing will require, but it will not hold good upon all Occasions. *Knaut*'s Method.

His first *Class* is of the *Monopetalous Flowers*, and these he divides into two Sections, *viz.* such as are *Flore Uniformi*, and such as are *Flore Diformi*; but as the general Rules he lays down for constituting this Class, as indeed most of other Classes of his Method, are faulty, so whatever Distributions are made in consequence of these Rules, must be faulty also, *v. g.*

1. He divides the *Flowers* into *Flores Perfecti* and *Imperfecti*. I have already observed how unsuitable this Distinction is, and I cannot acquiesce in Mr. *Ray*'s Distinction of a *perfect Flower*, according to him (*viz.* That a *perfect Flower* is such an one as always has *Petala*) for Reasons already given.

2. That

2. That the *Stylus* is no part of the Flower, but that it rather belongs to the *Fructification*. Now although *Malpighi's definition* of a *Stylus*, may and do's hold good, *viz.* That a *Capsula* nourishes, or rather preserves the Seed within its Cavity, yet its Appendix (commonly call'd the *Stylus*) only arises and appears among the *Stamina*; tho' it is not deny'd, that both the *Capsula* or *Pistillum* and *Stylus*, make up the *fructifying* Part, yet since, according to Dr. *Grew*, it makes up a part of the *Attire*, which he calls the *Seminiform*; and since no fertile Flower, when the *Pistillum* becomes the *Fruit*, is to be observ'd without it, except a few (such as *Papaver Capitatum*, and such like of that *Genus*) its Presence is as much requir'd to make up the whole *Compositum* of the *Flower*, as the *Petala* themselves.

3. That the *Stamina* are wanting in several, particularly the *Flores Aggregati*, such as *Flos Solis*, *Cyanus*, *&c.* This is a Mistake, for I have shewn that all the *Flosculi*, and *Semiflosculi* in these kinds of Flowers, have actually *five Columns* which arise from their inner Surface, as the *Stamina* in other *Monopetalous Flowers*, which afterwards coalesce and make up the *Vagina* in the *Flos Solis*, *Calendula*, *Hieraceum*, *&c.* And the Reason why they want the *Apices* here is, because the *Stylus* or *Capillamentum* upon the top of the *Embryones* supply their Office, by emitting

emitting *Globules* full of the *Farina* at their upper Part.

4. From whence he concludes, that no *apetalous* can be a perfect Flower, since the only Fence of a *Flower* consists in its being *petaloid*.

5. The *Fegopyrum*, *Bistorta*, *Persicaria*, &c. have naked, *petalous Flowers*, according to him, and therefore he says Mr. *Ray* is in the wrong for calling them *Perianthia*, according to his own *Definition*: That it do's not follow that the *Petala* are to be call'd *Perianthia*, because the *Flower* is not *Fugax*, nor *Caducus*, otherwise several *Petala* would be called *Perianthia*, which is contrary to known Experience: All this is own'd, and yet that do's not make the *Bistorta*, &c. have *petaloid Flowers*, for although their *Perianthia* be *Colore insignes*, which is one of *Tournefort*'s Definitions of a *Petalon*, yet they become the *Capsulæ*, or *Involucra Seminis*, which the true *Petala* never do, and are to be reckoned *apetalous*, therefore he justly observes, that *Helleborus Niger*, and *Veratrum*, are *petaloid Flowers* (which we have also remark'd elsewhere) because their *Petala*, although not distinguish'd much in the *Colour*, yet they never become the *Involucra Seminis*. The other *Articles* are much of a Piece with these, and therefore we shall not insist upon them.

When

When he comes to constitute his first Section of *Monopetalous, Uniform Flowers*, he takes it for granted, that neither the *Perianthium, Stylus*, nor *Stamina*, are Parts of the *Flower* (the contrary of which is immediately shewn) and therefore calls it that whose Margine is whole, or whose several Portions or *Laciniæ* are equal in respect to one another. And so he goes on in reducing all his *Monopetalous, Uniform Flowers* into a general Table, whereof *Valeriana* takes the first Place. *N. B.* I have observ'd, when discoursing of *Rivini*'s Method, if the *Regularity* and *Irregularity* of a *Flower* is to be establish'd for a Character, several Inconveniencies must follow such as that of separating of those Plants reckoned *Congeners* by all other Authors, merely upon the account of a nowise essential Circumstance of the Division of the Borders of a *Flower*, or the *Segments* and *Division* of a *Leaf*, which if always adverted to, would create needless and endless Trouble to *Botanists*, whereof this is a most pregnant Instance: *Valeriana* is class'd among the *irregular* Flowers by *Rivini*, which, as I said, unless it can be extended throughout all the Species of the whole *Genus*, deserves not to be admitted as a *Characteristick*, which it does not; for here Dr. *Knaut* places it among the *Uniform* or *Regular Flowers*, as the *Valeriana major Alba* do's indeed require; but since there are some Species of that same *Genus*

nus which have *irregular Flowers*; therefore either Dr. *Knaut* must recede from his Institution, or have the Honour of framing a new *Genus*, which I think is rather a Loss than an Advantage to *Botany*, when done upon the account of a mere Trifle, and against the common Consent of all Authors, *v. g. Valeriana* has a small, *tubulous*, *monopetalous Flower*, divided at the top into five *equal Segments*. It has a compound Leaf, or *Folium Pinnatum*, *Valeriana Minor Latif. Rub. & Alba. Morif.* has the same small *Flowers Umbellatim Dispositi*, but each of them are divided into five *irregular Segments*, like a Thumb and four Fingers, because of which and an undivided Leaf, though it be *Seminibus Papposis*, it must be sent a packing to another *Section*; and because the Affront upon it dare not appear abroad under the former Name, but must be distinguish'd by the Name of *Valerianoides*; and should another Plant like unto this *Valerianoides*, be yet found out, if it should have *equal Segments*, or rather the *Segments* plac'd at an equal Distance. If such a Plant should have an *undivided* Leaf too, whither could it go, or with which should it be join'd? In a word, such a needless Multiplication of the *Species* as this would bring *Botany* under great Inconveniencies, and be of no use to the *Tyrones Artis*. I shall not vindicate that *Chap.* of the *Umbellæ impropriè dictæ* in *Morison*; but he did not that

through Ignorance, since he calls such Plants *Umbelliferæ improprie*. Nor do I think the *Valeriana* comes more properly in among the *Flores Aggregati* by Mr. *Bobart*, for the *Institutors* of that *Genus* never meant *separate Flowers*, upon distinct *Pedicles* should be brought into *Affinity* with them. *Dillenius* observes, that the *Valeriana Palustris Minor*, has Male and Female Flowers, his Words are: "There is a Difference among the Flowers of "this *Valerian*, for some are Seminiferous, "more compactly united, like the Heads of "*Scabiosa*; other Plants of the same Spe- "cies have their Flowers more loosely di- "spos'd, so that throughout the whole Plant "the *Stamina* and *Apices* differ'd from the "*Styli* and Seeds. Those *Flowers* which "have the *Stamina* and *Apices* are larger, "and these which have the *Embryones* are "less [a]. I remember, that when I went a Herborising towards *Woolwich*, in Company with that accurate and expert *Botanist* Mr. *Rand*, we saw both, the *Valeriana Palustris minor floribus compactis*, and *laxioribus*, which then seem'd to us to be two distinct Species, because we had no Suspicion that there

[a] Valerianæ hujus diversi sunt: alii enim seminiferis qui magis congesti & in capitulum scabiosæ æmulum compacti: alii in aliis plantis laxiores & steriles sunt ita ut stamina & apices à stylis & seminibus tota planta removeantur: ii flores qui stamina & apices obtinent majores sunt, embryone autem donati minores. Dillen. p. 47.

would

would be *Male* and *Female-Flowers* in any Plant belonging to that *Genus*. The *Segments* of *Flowers* were indeed larger in one of the *Species* than in the other, but whether equal or unequal, I have forgot; they indeed did grow near to one another where-ever they were found, but whether *ab eodem semine satæ*, I shall not determine, but shall leave it to the further Enquiry of those who may Herborise in that Wood hereafter, being resolv'd to advance nothing for a Truth but what consists with my proper Knowledge and Experience: It's a pretty low Plant about one Foot high, with a strait Stalk, but little branched with the *Folia Pinnata*, proceeding from the Stalk by Pairs, having the *Flowers Umbellatim Dispositi* on the top. I shall not much debate whether it be *Gymno-monospermos* or *Enangio-monospermos*: Let them judge of that who shall examine it, according as they shall please to accept of naked Seeds in a more or less *strict* Sense; but I am ready to join in with *Knaut*, who says, *Capsulam habet striatam in quâ semen oblongum acuminatum cortice proprio involutum continetur. Mirabilis Peruviana sive Jallapa* is the next, and well deserves to be term'd a *Flos Monopetalus Uniformis*: though I am ready to look upon it as a distinct *Genus*, yet by its *Flower* it comes very near to that of a *Convolvulus*; and though *Heucherus*, as cited by our Author, will not have it to be a *Convolvulus*; *quia nec lactescit nec*

convolvit (I suppose he means *Campanula* also by the first) but a Species of *Mirabilis*, because it purges pretty smartly: Yet Dr. *Herman* would rather chuse to have it a *Convolvulus* upon that account, for he says that most of the *Convolvuli Species*, such as *Scammonia*, *Mechoacanna*, *Jallapa*, are all of them Purgatives. Now since I am very well satisfy'd that the *Jallapa* is a Species of the *Mirabilis Peruviana*, as 'tis not only found to be so, by the accurate *Father Plumier* who first found it out, but also by the Grain, Colour (when cut transversely) and Taste of the Root, it appears to be so, yet it would have been no less purgative, had it been a *Convolvulus*, as Dr. *Herman* asserts, who I believe when he wrote his *Hortus Lugduno Batavus*, knew nothing to the contrary; neither is there any great Odds in the Flower; but the *Mirabilis Peruviana* having an *Enangio-Monospermos* Seed, makes the Difference, for all the genuine *Convolvuli* are Tricapsular.

He's so very earnest to have these esteem'd by all other Authors, as only the *Foliola Perianthii*, look'd upon as *Petala*, that he brings *Knawil*, *Beta*, *Blitum*, *&c.* among the *petalous Flowers*, which was never done by any before him; that he will have them to be *Enangiospermæ*, though he cannot procure the Seeds to be *Capsular*, any otherwise than either before they are ripe to turn them out of their proper Membrane, or by blanching them, as

as it is call'd, among warm Water, as if an Almond were *Enangiospermos* too, because the Heat of the Water obliges it to throw its Coat. I shall not say much for the *Beta*, because there are sometimes two or three of them together, and they may be look'd upon as *Capsular*; but for *Parietaria*, I shall never think it has another *Capsula* than the *Calix* or *Perianthium*; nor can *Beta* be allow'd to have any other than an apetalous Flower. He tells us, that *Rhabarbarum male pro Specie Lappathi habetur*. Now if three of these six Segments do not become the *Seminis Capsula*, and the other three do not become its base, then it is not a *Lappathum*; but if the contrary be the Fact, then neither *Tournefort* nor *Knaut*'s Interest, can shew any other than that it's a *Lappathum*, considering how far they agree otherwise in the *Facies Externa* and *Plantæ Habitus* He brings in the Trees too among the Herbs, and makes them to have *monopetalous Flowers*. This is so far out of the common Road, that if every one would give himself such a Latitude, *Botany* would depend upon the *Caprice* of every Fancy, so that the searching after Fact would be neglected, and *Botanick Authors* would be rather depended upon, than the *Dictates* of *Nature*. Dr. *Knaut* has learn'd this Indifferency concerning the *Distinction* between *Herbs* and *Trees* from *Rivini*, which was the Ground-Work of those two dissertatory

Letters betwixt Mr. *Ray* and him; and altho' no regard were to be had to the *Herbaceous* and *Ligneous* Texture of the Plants; yet Mr. *Ray*'s *momentous Argument*, That all *Trees* are *Gemmiparous*, which *Herbs* are not, might have been ſufficient for to have mov'd Dr. *Knaut* to let the *Celebrated Rivini*'s Diſtinction fall. 'Tis true, that ſeveral of the *Suffrutices* are *Gemmiparæ*, which I have remark'd elſewhere; but Mr. *Ray* anſwers that Objection very handſomely, That after they have become *Ligneous*, or *Fructeſcent*, they may have *Gemmæ*, but he denies, and juſtly too, that any annual Shoot, eſpecially of the firſt Year (for then they are always herbaceous) have any *Gemmæ*, ſo that its mere *Humour*, and to be *juratus in verba Magiſtri*, that can oblige him to make no Diſtinction between *Herbs* and *Trees*, even tho' they ſhould agree in all their Characterick; nor can his making *Ulmus* have a petalous *Flower*, be otherwiſe than to affect a Singularity.

He makes a great work with the *Characteres Plantarum*, and is angry with Mr. *Ray*, Dr. *Herman*, *&c.* for eſtabliſhing a new Claſs of *Aſperifoliæ*: 'Tis an old Claſs, and us'd before *Claſſing* by the *Flower* and *Fruit* was thought on; and now, ſince the *Flower* and *Fruit* do conſpire with the *Folia Aſpera* and *Alternata*, I ſee no Reaſon why they ſhould be dis-join'd, becauſe of a *circumſtantial Equality*, or *Inequality* of the *Segments*;

therefore I think *Echium* ſhould come equally in here with *Borrago*, *Conſolida*, &c. Every one who knows both, muſt needs look upon *Symphytum Maculoſum*, or *Pulmonaria*, to be a diſtinct *Genus* from *Conſolida* or *Symphytum Maj.* but *verba valent uſu*, as in the *Centaurium maj.* and *minus*; for the *Pharmacians* have four *Conſolida's*, by which they would import the Virtues, not the *Botanical Genera*, v. g. *Conſolida maj.* i. e. *Symphytum maj.* which is *Aſperifolia*, *Conſolida Saraſenica*, *Solidago Saracenica*, which is a *Jacobæa*; *Conſolida media*, i. e. *Bugula*, which is an *unilabiate* Plant. *Conſolida minima*, i. e. *Bellis minor*; ſo that it's better to retain the old Names, and to name the Plants in their different Reſpects, than by giving them new Names to make them be miſunderſtood.

As to what he ſays concerning the *Seeds* of the *Omphaloides* and *Cynogloſſum* to be *Capſular*, and that all the other *Aſperifoliæ* are ſo too; I know not how to deal with him, who if he cannot find out the *Capſula* of a *Seed* any other way, will do it by warm Water; but otherwiſe the *Cynogloſſum* is more *Capſular* at the firſt View than any of the others, which may be look'd upon as *Gymnoſpermæ* in reſpect of it; and this made me (before I knew Dr. *Plucknet* had done it) claſs the Plant commonly called *Echium Marinum*, with the *Cynogloſſum*, though *Tournefort* brings it in with *Bugloſſum*, for it has a *Cynogloſſum*, *but*

blue Flower, and four Capsular Seeds, so large that the Calix *is scarce able to contain them when they are ripe. It's a low Plant, lying upon the Ground, of a bluish Leaf like unto Coleworts, which made some People mistake it so far, that they boil'd and eat it for Coleworts in Time of Famine, when the Virtues of the* Cynoglossum *exerted themselves so far as to make some People sleep to Death, and others that were stronger did not awake till after a long Time.* See my *Miscellaneous Observations.*

He will needs have *Malva*, *Alcæa*, *Althæa*, and *Malva Arborea* to be the same *Genus*, and says, *Tournefort*, *Ray*, *Preſtone*, have err'd, because they make them distinct *Genera* upon the account of their *Calix* or *Perianthium*. With his leave I think the *Calix* (let him reject it from being the part of a Flower, as he has a mind) is as good a *Generical Note* as the Equality and Inequality of the *Segments*, and therefore do fully go into Dr. *Preſtone*'s Sentiments concerning the Sufficiency of the *Perianthium* for constituting three *Genera* of the other *malvaceous Plants*; and if it were not for the regard had to the *Perianthium*, they might make up five. The *Malva* has three outer and five inner *Foliola* of the *Perianthium*, which but half cover the *Capsulæ*, *Stylum rotatim Cingentes*, and therefore each of the *Capsulæ*, are as it were *dutail'd* (as the Carpenters call it) or *indented* with

with the *Stylus Medius*, to preſerve the Fruit from falling off till it is ripe. The ſame is obſervable in the *Malva Arborea*, with this Diſtinction, that the outer *Foliola* of the *Malva Arborea* are large and round, whereas the other are leſs and pointed. The *Malva Arborea* is alſo *Pentacapſular*, which might conſtitute a new *Genus* were the Number of the *Capſulæ* ſufficient to determine it here; and the *Malva* is *Multicapſular*. *Althæa* and *Malva Roſea* have a double *Perianthium*, which cloſe ſurround and cover the *Fruit* at the top; add likewiſe, that the *Capſulæ* of theſe two are more flat, and all the other rounder; ſo that though the *Althæa* has but a *ſmall Flower*, and *Malva Roſea* a very large one, yet ſince they agree in the *Perianthium*, *Fruit*, and *toto Plantæ Habitu*, I ſhould not have grudg'd to have look'd upon them as one and the ſame *Genus*, if a long and continued Uſe had not forbid to alter their Names. *Alcæa* makes a very diſtinct *Genus*, by its ſingle *Bladder Perianthium*; for the *external Foliola*, are very ſmall and pointed. *Dillenius* very juſtly obſerves, that the *Tubus Pyramidalis* in the *Alcæa*, is always inclin'd to one Side, and therefore in *Rivini*'s Senſe, it may be plac'd among the *irregular Flowers*. *Malacoides*, *Abutilon*, *Ketmia*, *Xilon*, are very juſtly plac'd next to the *Malvaceous Genera* in one Section, becauſe although they differ in the Fruit, the *Malvacea* being *rotatim Circumacti*,

cumacti, and the other for the most part *in Capitulum congesti*; and therefore I know not why *Knaut* should have remov'd the *Ketmia* to such a Distance, and given the Name of *Althæa*, to confound it with another Plant which has so long pass'd under that Name.

I know not why he should have plac'd *Rubia* betwixt *Phyllyræa* and *Jasminum*, I'm sensible it has a different *Fruit* from the other *Stellatæ*, i. e. it has a soft Berry, but it is still the same, as to the Number of two Seeds. Sometimes Dr. *Knaut* will not admit of the *Perianthium*, *Disposition* of the *Flower*, &c. as *generical Notes*, and at other Times he is angry with those who do otherwise. Thus he blames *Tournefort* for joining *Asperula* with *Aparine*, *Nummularia*, with *Lysimachia Lutea*, &c. I have observ'd this before, and think it was amiss in *Tournefort* to do so, because I'm of Opinion that the Disposition of the *Flower*, *Leaf*, and other Parts of the *Plantæ Habitus*, ought to be specially regarded in a great many Cases; but for Dr. *Knaut* to do so, is to depart from his own Principle, which is to have a special regard to the *Fashion* of the *Flower* only. He has the same Observation with *Dillenius* concerning the *Rubia parvo flore*, viz. That *vascula habet exigua oblonga, in summo digitata, singulis floribus succedentia gemina, in quibus singulis semen continetur fulvum, alterâ parte gibbum, alterâ verò planum*; and for this Obser-

vation

vation he cites no leſs than three celebrated Authors, *Bauhinus*, *Moriſon*, *Ray*. So that if *Dillenius* had been to make a Preſent of the Name to ſo *Eminent* a *Botaniſt* as Dr. *Sherard*, he ſhould have made it of a *Non-deſcript*, and not of a Plant which has been ſo nicely deſcribed by ſo many before him. And for the *Nummularia*, and *Anagallis Lutea*, they ſhould at leaſt have been plac'd next to the *Lyſimachia*, and no ſuch Plants ſhould have interven'd, as *Samolus* and *Soldanella*) for they agree very much with the *Lyſimachia* both in *Flower* and *Fruit*. Dr. *Sherard* has obſerv'd two Species of the *Lyſimachia Lutea*, the one whoſe Flowers are more *diſperſed ad Foliorum alas*, and the other more compact *in Caulis Cacumine*. I have already taken notice of the Relation betwixt *Gentiana* and *Centaurium minus*. There ſhould ſtill be ſome Reſemblance in a Plant beſide the noted *Characters* to invite to a Proximity in Diſtribution, and therefore *Gentiana* comes but ill in betwixt *Trifolium Paluſtre*, and *Viola aquat. Caule nudo*. *Mandragora*, is not ſo near of Kin to *Lilium Convallium*, as our Author would have them. *Cerinthe* ſhould not come near to *Centaur. min.* nor *Bella dona* to *Liguſtrum*. *Convolvulus* ſhould have had *Quamoclit* for a Neighbour, notwithſtanding what may be alledg'd to the contrary. If the Equality of the Segments are always to take place, then ſeveral Species of

Plants

Plants must be dis-join'd from their *Congeners*, v. g. *Gladiolus Lacustris Dortmanni, has a tubulous Flower, divided into five unequal*, i. e. *two erect or upper, and three lower Segments, notwithstanding which it corresponds with the* Campanula Pratensis minor, *exactly in the Fructification (as I have observ'd in my* Miscellanies): Which because it is esteem'd a genuine *Campanula* by *Tournefort*, I likewise entitled the *Gladiolus Lacustris* so too; but since Dr. *Morison* is pleas'd to Class that *Campanula minor* among the *Rapunculi*; and since 'tis Dr. *Sherard*'s Opinion this *Gladiolus* is a *Rapunculus* too, I would yield it, and still look upon both to be different Species, yet to be near of Kin, if not of the same *Genus*, notwithstanding the Equality and Inequality of the *Segments*. Our Author it seems, do's not look upon *Campanula* as worthy of a Place among his *Genera*, at least he makes the Distinction betwixt it and the *Rapunculus* to be but small, since according to him they only differ in the more deep or more superficial Division of the Segments. *Crocus*, *Narcissus*, and *Colchicum*, by their *Root* and *Facies Externa*, should have been brought into the Neighbourhood of the *Lillies* and *Irides*, as *Tournefort* has done. And for the *Aloes*, it do's not always properly belong to this Place, for there are several Species whose Flowers have unequal Segments. There was

no

no neceſſity for interpoſing the *Pomiferæ Scandentes*, ſuch as *Cucurbita* and *Cucumis* (to which *Bryonia* ought to have been join'd, rather than to *Mandragora*) betwixt the *Aloes* and *Ficoides*, which agree in the *Facies Externa*, though not in the Flower; for though I have for ſome time been of the Opinion, that the *Ficoides* has the Flower of an *After*, and I find ſeveral others have been of the ſame Mind too; yet upon examining the Flowers themſelves, I am now undeceiv'd. Our Author is in the right when he ſays it has a monopetalous Flower; and ſince I find there have been ſeveral Miſtakes about it, I ſhall give a more particular Deſcription of it. *Tournefort* ſeems to have obſerv'd it pretty well when he ſays, "That it has a *Flos Monopetalus Companiformis* (according to his manner of Claſſing the Flowers) divided into ſeveral minute or narrow Portions, perforated in the bottom, by which it is articulated with the *Piſtillum*; when the Flower is decay'd both *Piſtillum*, and *Calix* become a *Multicapſular* Fruit[a]". This is pretty near to what I have obſerv'd, viz. *That it has a monopetalous Flower, deeply divided into many ſmall, narrow, flat, or*

[a] *Ficoides c'eſt un genere de plante dont les Fleurs ſont des cloches evaſees, de coupee ordinairement fort menu & precedans le fond ou elles s'articulent avec l'epiſtle, lors que les fleurs ſont paſſés, le ſtile & le calice devieunent tous les deux en ſemble un fruit diviſe en pleuſeurs logis rempli des ſemences. Tourn. dans les Memoires de l'Academie Royal des Sciences, pour L'an 1705. p.* 313.

plain

plain Portions, or Segments dispos'd in a Circle, not unlike the Flower of an Hieraceum *or* Dens Leonis, *and some of them so small as the* Lactuca, *or some of the small Starwort Flowers. All these Segments being conjoin'd in the Center, frame a hollow Tube, more or less superficial, like to that of the* Malva, *in which the upper part of the* Pistillum *is lodg'd, from whence arise a great many small, short* Stamina, *with their* Apices *more or less elevated in the middle of the Flower. Sometimes the Segments are so very small as the* Stamina *themselves, from whom they can scarce be distinguish'd but by their Situation and* Apices. *The Flower is plac'd upon the top of an enlarg'd* Calix, *which when the Flower begins to decay, has some Resemblance to a Fig, which induc'd Dr.* Herman *to give it the Name of* Ficoides. *The* Calix *has usually five, thick, succulent Leaves of the* Perianthium, *which surround the Flower before it is blown. The Fruit is for the most part* Pentacapsular, *as I have been inform'd by that accurate, expert, and ingenuous* Botanist *Mr.* Rand, *but sometimes Multicapsular.* It is called *Kali Africanum* by *Ammannus*, or rather *Kali Floridum Aizoides* [a], *Chrysanthemum Plucknet*: *Chrysanthemum Aizoides Bryen. est Planta Multicapsularis, Polyspermos, Pachyphyllus*

[a] Ammann. Charact. Plant. p. 438,

floribus

floribus discoidibus radiatis, *Bobart* [a]. It is not many Years since this Plant was first brought into *Europe*, but it has since multiply'd into a great many Species; though the distinctive Notes are not yet fully establish'd, they make up a large Share of the succulent Plants. The *Ingenious Mr.* Bradly, as I have observ'd, has accurately delineated several of them, and places them among the *Chrysanthema*. Their Number has now so far encreas'd, that the ingenuous and most expert *Gardiner Mr.* Fairchild has alone in his Garden at *Hoxden*, thirty six several Species, with as many *Aloes*, beside succulent *Tithymals* and *Asphodels*, which is more than has been hitherto seen in any private Garden in *Great-Britain*.

Oxys S. Trifol. Acetos. comes odly in betwixt the foregoing *Ficoides* and the *Ketmia*, which, as is observ'd, belongs to the *malvaceous* Tribe, but he has separated them after the Example of the *Flora Batava*. *Asarum* is the last save one of this Section, though our Author has but small Reason to bringit in a-among the petalous Flowers, but of this already.

Our Author, *Sect.* 2. which he entitles *De Plantis Flore Monopetalo Difformi*, will not admit of the *Irreglarity* of the *Perianthium*, the *Stylus* not occupying the middle of the

[a] Hist. Oxon. Part. 3. p. 506.

Flower,

Flower, nor the difference betwixt the Number of the *Stamina* and that of the *Laciniæ*, or *Segments* to infer an *Irregularity* or *Deformity*, becauſe he do's not look upon them as eſſential Parts of the *Flower*. So that the Deformity only depends upon the *Petalon*; and he puts the Queſtion, whether this *Irregularity* depends upon the Border or long Tube of the Flower? And ſome he ſays will have it to proceed from the middle or *Ungues* of the Flower; but ſince there are ſeveral *Flowers* which in the bottom and middle part are incurvated and gibbous, notwithſtanding which they are eſteem'd as irregular Flowers by *Botaniſts*; ſuch as *Verbaſcum*, *Borrago*, *Symphytum*, *&c.* Therefore they are not to be eſteem'd irregular becauſe of a gibbous *Tube*; but the whole Deformity of the *monopetalous Flowers* depends upon the top or *Margine* of the *Petalon*.

According to *Jungius* and Mr. *Ray*, he divides the irregular monopetalous Flowers, 1. Into *Semifiſtulares*, as *Ariſtolochia*. 2. *Corniculati*, or *Calcari Donati*, as *Linaria*. 3. *Labiati*, which are either *Labio Simplici*, or *Gemino*, otherwiſe *Unilabiati*, or *Bilabiati*; and he tells how condeſcending he is in complying with other *Botanick* Authors in this: "But, ſays he, leaſt I ſhould ſeem wil-
"ling to be look'd upon as wiſer than all others,
"I eaſily allow, that the Diſtinction made by
"common Conſent of the unilabiate and bi-
"labiate

" labiate Flowers be ſtill retain'd, and let eve-
" ry one uſe his own Judgment *. I have ſpoke of the *Valeriana Marina* already, which is the firſt of this Sect. *Dipſacus* and *Globularia* may ſtill be retain'd among the *Flores Floſculoſi in Capitulum collecti* of *Tournefort* or *Aggregati*, along with the *Scabioſa*, notwithſtanding all he can alledge to the contrary; for though the *Perianthium* in the *Dipſacus* is not common to all the *Flowers*, yet the *Floſculi* being thick ſet together, I think is ſufficient to make it a *Flos Aggregatus*. He is ſo nice as to ſeparate *Trifol. prat. alb. & purp.* and *Echium*, the one from the Congener *Trefoils*, and the other from the other *Aſperifoliæ*, on purpoſe to ſhew how exact he is in *Criticiſm*. He goes on from thence with the *Labiatæ Tetraſpermæ*. It is not neceſſary I ſhould inſiſt upon their ſeveral Diſtributions, ſince they are brought together by the common Conſent of other Authors. He challenges Mr. *Ray* for not obſerving, that the middle Lip in the *Flower* of the *Salvia* is bifid. I ſuppoſe 'tis the lower Lips that he means, but if he would look narrowly, he would find, that the upper Lip of the *Salvia* is *in duo Labia Fiſſum*. He proceeds to the *Diformes Capſulares*. He's too nice with the *Hyoſcy-*

* Cæterum ne ſolus plus omnibus ſapere velle videar, facile patiar, ut recepta communibus Suffragiis diſtinctio n unilabiatos & bilabiatos flores retineatur, & ſuo quilibet ſenſu abundet. Knaut. Meth. Plant. p. 80.

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amus to bring it in among them. *Cymbalaria* is indeed nearer of Kin to the *Antihirrinum minus arvense* than to *Linaria*, but there can be no Relation betwixt *Antihirrinum* and *Veronica* as to the Flower. I do indeed look upon *Digitalis* and *Gratiola* as distinct *Genera*, but they are *Affines* or ally'd to each other; and I am of the mind *Arum* and *Dracuntium* are *generically*, as well as *specifically* different, the one being *Cauliferous*, which the other is not; for the Flower of the *Arum* arises upon a proper Pedicle.

Cl. 2. He treats of the *Monopetali Aggregati*, and these again he subdivides into the *Uniformes* and *Diformes*, both which he subdivides again into the *Papposi* and *Non-papposi*. In this Class he separates several of the *Capitatæ*, several of the *Corymbiferæ*, and several of the *Flore flosculoso* and *Semiflosculoso* of *Tournefort*, according as he imagines they have equal or unequal *Segments*. He has a third Section, wherein are contain'd those Plants which have both equal and unequal Segments together. In this are *Jacea*, *Cyanus*; among the *Flores flosculosi*, *Helenium*; among the *Semiflosculosi* *Doronicum Flos Solis*, and most of the *Radiati*.

Cl. 3. Is but a short Class of the Dipetalous Flowers, whereof we have only one *European Genus* among the *Uniformes*, *viz.* *Circea*, and a few among the *Diformes*, such as *Fumaria*, *Capicoides*, &c.

Cl.

Cl. 4. Of the *Tripetalous Flowers*: These are but a few also to make up a Class. They are for the most part Water-Plants, whereof the *Plantago Aquat.* and *Sagitta* make the greatest Number. They are reckoned *Ranunculi* by *Tournefort*, but as our Author justly observes, the *Ranunculi* are for the most part Pentapetalous, and these are all Tripetalous, though they agree pretty much in the Fruit, in so far as they are *Gymno-polyspermæ*. Plantago Aquat. Major, *has the least Flower of any of its* Congeners. Dillenius's *Observation concerning the Male and Female-Flowers in the* Sagitta, *whereof hereafter, holds good here too, for I have observ'd, that there are several Stalks which are loaded with Male-Flowers, and several with the Female or fertile ones, but whether from the same Root I am not certain. The Male-Flowers are larger, whiter, the* Petala *more expanded, and more conspicuous, the Stalks also of a paler Green, and the Husks after the* Petala *are fallen off, remain empty. The Female Flowers are more reddish, the* Petala *less, and not so conspicuous, nor so fully expanded, being a little bended inwards, the Stalk darker Green*; *the Stalks of both are triangular branched towards the top by Intervals*, i. e. *three Branches always proceeding together from the Stalk, and sometimes having three smaller Pedicles loaded with Flowers in the Intervals, betwixt the three*

larger Stalks. The Fruit is alſo triangular, conſiſting of ſeveral naked Seeds in Capitulum Collecta. It, with the *Minor*, are more properly *Aquitales* than *Aquaticæ*, i. e. their Soil is not ſo much in the Water as upon the Sides of the Rivers and Ditches, or in moſt watry Places. The *Minor* has large Flowers, in Proportion to the other: Its *Capitula* are larger, and ſomewhat ſpherical, whereas the other is flat at the top, and almoſt triangular. There are three Species of the *Sagitta Aquat.* here about *London*, viz. *Sagitta Aquat. Maj. Latifol. Sagitta Anguſtifol.* and *Sagitta omnium minima.* The Obſervation of the late expert *Botaniſt* Mr. *Samuel Doody*, is very memorable, *viz.* That the *Gramen Aquat. Bulbiferum, C. B. P.* is the ſame with the *Sagitta Aquat.* and being lately in Company with the accurate *Botaniſt* Mr. *Rand*, I was by him inform'd, and obſerv'd that it was ſo, for we plainly ſaw in a River, not far from hence, this Gramen Aquat. Bulbiferum, *having Leaves about a Foot and a half or two Foot long, and about one Inch broad, floating under Water; and as it inclin'd towards the Surface, it ſent forth long Pedicles, with oblong Leaves upon the top, about three, four, or five Inches long, and about one and a half or two Inches broad; after which we obſerv'd a third Series of Pedicles, which as ſoon as they had arriv'd at the top of the Water, they produc'd the* Sagitta *or Arrow-head-*

ed Leaf, ſome more narrow, and others larger and broader in different Species; amidſt theſe aroſe a long round Stalk, which as ſoon as it mounted above the Water, ſent forth Flowers diſpos'd upon Joints by Intervals, three and three together round the Stalk; the lowermoſt had but ſhort Pedicles, and being come to the Fruit it was Spherical. *Dillenius* obſerves, that the *Sagitta Aquat.* has *Male* or *barren*, and *Female* or *fertile* Flowers, and that the *Petala* of the *Male-Flowers* were more extended, and larger than thoſe of the Female, of which I have given the Figure; whether it is ſo or not I ſhall not determine, but leave it to farther Examination, only that all the Spikes or floriferous Stalks I procur'd out of the River, I ſaw the three *Capitula* of Seeds at the firſt Joint; and thoſe above were the *Petala*, fallen off, and were empty *Calices*. The Flowers, ſuch as he deſcribes the Male-Flowers to be, were upon the top of all; but whether the *Calices* were empty until the Seeds ſhould be fill'd, I am not able to make any Judgment, ſince I had not the opportunity of ſeeing the Female-Flowers, ſo as to be able to make a Diſtinction. Mr. *Petit*, ſometime Surgeon in the Hoſpital of *Namure*, who ſeems to be an expert, inquiſitive *Botaniſt*, gives the Figure of a ſmall Water-Plant, which he calls *Ranunculus Paluſtris fol. Gramineo & ſubrotundo.* "He ſays it has a ſmall fibrous Root (and

" perhaps bulbous too, for the *Sagitta* has a " fibrous Root beſide the bulbous part) two " ſorts of Leaves, the one plain, ſix Inches " long, and about two broad. The other Oval " an Inch long and half, and an Inch broad; " theſe are green, ſupported by Pedicles one " Foot high. There do alſo proceed from " the Root ſome Stalks (*Tiges*) ſometimes " one Foot high, branch'd at the upper part, " bearing Flowers like the *Ranunculus He-* " *deraceus Rivulorum ſe extendens*, ſo far as " as he remembers. Now by the two diffe- " rent Leaves which by the Figure appear to " to be of the ſame Shape with thoſe I ſaw " upon the *Sagitta*; but the ſmall Account " he gives of the Flowers, I take it to have " been a *Sagitta Minima*, See his Deſcrip- tion in the Note at the bottom *.

But

* Ranunculus paluſtris, foliis gramineis, & ſubrotundis. La racine de cette plante eſt compoſée de quantité de fibres blanches, dont les plus groſſes quantité n'ont pas la quatriéme partie d'une ligne, & les plus longues ſont de demi pied.

Cette racine pouſſe deux ſortes de feüilles, les unes ſont plates, & longues de ſix pouces plus ou moins, larges de deux lignes, & ſe terminent en pointe, blanches à leur naiſſance, mais tout le reſte eſt verd, ces feüilles ſont au fond de l'eau.

Les autres feüilles ſont ovales, les plus grandes ſont longues d'un pouce, & larges de demi pouce, elles ſont vertes, portées ſur de pedicules longs d'un pied, qui on tout aux plus le tiers d'une ligne d'épaiſſeur. Ils ne ſont pas ſi verds que les feüilles qui nagent ſur l'eau.

La racine pouſſe auſſi des Tiges qui n'ont quelque fois pas un pied de hauteur, elles ſont branchues dans leur partie ſuperieure. Les fleurs naiſſent de ces branches, elles ſont aſ-

ſez

But that which confirms me most in *Dillenius* his Opinion, that there are Male and Female Flowers in the *Sagitta Aquatica*, is the Account Dr. *Tournefort* gives of the *Nymphæa Alba Minima sive Morsus Ranæ*. *The least Water Lilly, or Frog bit. This has a little round, stiff, shining* Nymphæa *Leaf, about one and a half or two Inches diameter upon the top of each Stalk and Branches, the Flowers proceeding by Pedicles from the Branches, are tripetalous, white, with several small* Stamina, *and* Apices *in the middle about the same Bigness, with the tripetalous Flowers upon the top of the Stalk of the* Sagitta Major. *Now I take these I saw to have been only Male-Flowers*, 1. *Because they were such* (as is said) *as are represented by* Dillenius *under the Name of Male-Flowers upon the* Sagitta. 2. *Its* Calix *is said to become the Fruit, which it could not do here, beeause there was no Enlargement of the Pedicle, which always happens in fertile Flowers, when the* Calix *becomes the Fruit.* 3. *From Dr.* Tournefort's *Observation.* Thus *Morsus Ranæ*, says he, " is " a Plant which produces two sorts of Flow- " ers, the one Male and the other Female;

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fez semblables à celles de Ranunculus Hederaceus rivulorum, se extendens, atra maculâ notatus, J. B. 3. 782. si je m'en souviens bien, car lorsque j'ay trouvé cette plante nous étes tous sur le point d'étre asiiegé, je n'ay pû la décrire sur lieux. Lettres d'un Medicin de l'Hopital, Let. 3. p. 47.

" both are Rosaceous and Tripetalous. The " *Calix* of the *Female-Flowers* become an " oblong Fruit, for the most part divided in- " to six Loculaments or Pouches full of small " Seeds" *. *Cælsapinus* also says its *Hexacapsular*. This Account both confirms *Dillenius*'s Observation concerning the *Sagitta*, and mine of the *Platago Aquat.* as above, and shews the *Morsus Ranæ* has also Male and Female Flowers, with this difference, that the Flowers alone are adherent to a proper Stalk arising from the Root; and the other are *Flores Solitarii è Foliorum alis*. This *Morsus Ranæ* seldom bears the Fruit, because it has a very running Root, therefore I cannot determine of the fertile Flower, and can only give the Account of the Fruit from Dr. *Tournefort*, because I never did see it my self.

Next to the *Morsus Ranæ* are to succeed the following Plants, *viz. Plantago Aquat. min. Stellata Raii Meth. emend. p.* 78. of which he gives the following Notes: *Foliis ut & floribus tripetalis cum plantagine aquat. minore convenit, siliculis membranaceis*

* Morsus Rane, c'est un Genere de plante qui produit deux sortes des fleurs: des novees & d'âutres qui ne sont pas novees les unes & les autres sont en rose composees de trois feuilles (*ou plutot petal*) disposees de tour du meme centre le calice de fleurs devient un fruit oblong partagé le plus souvent en six Logees remplis des sementes assez menues. Memoires de l'Academie Royal des Sciences 1705. p. 311.

stellatim

ſtellatim diiſpoſitis plurimis unicuique flori ſuccedentibus ab eadem differt. "This "Plant, ſays he, agrees with the *Plantago* "*Aquat. Minor*, both in the Leaves and "tripetalous Flowers, but by its ſmall Mem- "branous *Pods*, diſpos'd Star-like, and ſuc- "ceeding to each *Flower* it differs from it." Since Mr. *Ray* gives neither the *Synonyma* nor *Locus Natalis* to this, nor does he mention it in his *Synopſ. Stirp. Brit.* it muſt be let alone till farther Accounts be given of it, only by the Notes it comes in with *Morſus Ranæ*, both in the Flower and Fructification, and with the following.

Juncus Floridus. Tournefort *having miſtaken its Flower, I have thought fit to give the following Account of it.* Tournefort *ſays, that* Plurimis Petalis majoribus & minoribus conſtat; *but 'tis plainly a tripetalous Flower, with a triphyllous* Perianthium; *for theſe which he calls* Petali Minores, *are truly the three Leaves of the* Perianthium *which cover the* Petala *before they are blown, and after Expanſion appear in the Interſtices of the* Petala, *almoſt of the ſame Colour within, which was the Ground of the Miſtake, but greeniſh without. It has nine* Stamina *and round* Apices, *with a hexacapſular, membranous Fruit. I rather join it with the two former, becauſe of the Flower and Fruit, than make it* Bulboſis Affines *with Mr.* Ray, *when it has a ſmall fibrous Root. For the*

Plantæ Facies, *it's rather like a* Cepa *or an* Allium; *but its Flowers are not* in Capitulum Collecti, *but* Umbellatim Disposiri, *by so many distinct Pedicles upon the top of the Stalk.*

Cl. 5. Has the *Flores Tetrapetali.* Among these he brings in *Potamogeiton*, which is an apetalous, *Tormentilla* which he has no Reason to separate from the *Pentaphylla*, because of the *tetrapetalous Flower*, for it often varies into *pentapetalous. Thalurum, papaver capitatum, Monophyllum, Corindum, Cornus, Ruta, Syringa, Herba Paris.* All these, as they make up but a confus'd Class, when join'd in with the *Siliquosæ* and *Siliculosæ*, so several of them swerve from the general Rule, *viz.* That all the *Unicapsulares* and *Bicapsulares* have *sex Stamina, v. g. Papaver Capitatum* is *Unicapsular*, according to his own Confession, and yet it has a vast Number of *Stamina.* I think the *Bacciferous Plants* should not be join'd in common with the rest, unless in a separate *Section.* Herba Paris. *has its* Petala *very inconsiderable, for the greatest Appearance of its Flower depends upon the Largeness of the four broad Leaves of the* Perianthium *which are greeneſt, for the four* Petala *are long, narrow and pointed. It has eight* Stamina, *according to the Observation of that expert* Botanist *Mr.* George Prestone, *Brother to the late Celebrated Dr.* Charles Prestone, *and present Intendant of the Physick Garden at* Edinburg.

Sect. 2.

Sect. 2. The *Tetrapetalæ Difformes*, are the *Flores Papylonacei*, or *Plantæ Leguminoſæ*. Theſe are claſs'd together by the general Conſent of all Authors, and for the Diſtribution of them, that depends upon the Fancy of the ſeveral Methodiſers.

Claſs 6. The *Pentapetalæ* are very confuſedly mix'd together. The *Umbelliferæ*, with thoſe that are are not properly ſo; either his Obſervation or mine muſt have fail'd, or *Hydrocotyle* has two Seeds ſucceeding to each ſmall *pentapetalous Flower*. *Eryngium* is likewiſe an *umbelliferous Plant* in that reſpect, both by the Flower, two ſucceeding Seeds, and Leaf too, as Dr. *Sherard* well obſerves, notwithſtanding Mr. *Ray* will needs *Claſs* it along with the *Dipſacus*.

Sect. 2. The *Pentapetalæ Difformes*, for the moſt part contain ſuch as are claſs'd among the *Polypetalæ Anomalæ*. *Claſs* 6. *Hexapetalæ Uniformes*, contains many of *Tournefort*'s *Liliaceous Flowers*, together with *Anemone*, *Pulſatilla*, *Filipendula*, *&c.* I ſee no Reaſon why *Anemone* in this, and *Hepatica*, *Chelidon*, *min.* *Flos Adonis* in the *polypetalous Claſs*, ſhould be dis-join'd from their *Congener Ranunculi*.

Sect. 3. *Hexapetalæ Difformes*, are the *Orchades* and their *Congeners*, ſuch as are *Ophrys*, *&c.* To which are added *Delphinum* and *Staphiſagria*. I ſuſpect ſome in this Sect, will be found *Monopetalous*, divided into ſix unequal Segments.

Claſs

Class 7. The *polypetalous Flowers* has only two remaining, besides *Hepatica*, &c. The *Flos Trollius*, as he calls it *Ranunculus Montanus Aconiti Fol. Flore Globoso*, It is justly said to be a *Pseudo-Helleborus*, as I have observ'd in my *Miscellanies*.

The last Plant, and only *Planta Flore Difformi Polypetalo*, is the *Aquilegia*. It has five *Petala Corniculata & Tubulosa*, and so many *Plana* alternately plac'd; and yet I do not see how this can be call'd a *Planta Difformis*, since all the *tubulous Petala* bear a Proportion to one another both in their Bigness, Figure, and equal Distance from the Center: So do also the *Petala Plana*, and if in either of these they keep in their true Dimensions, have the same Figure in Relation to, and are at the same Distance from each other, and from the Center; I know not how this can be call'd *Flos Difformis*.

Our Author, by this way of doing, has thrown off very near one third of the Vegetables from being Plants; nor could they be well admitted, since he'll receive no other but such as have conspicuous Flowers, therefore the *Frumenta* and *Gramina*, the *Capillares*, the *Musci*, *Algi*, *Fuci*, *Fungi*, *Confervæ*, *Submarinæ*, *Lithophytæ*, &c. are all of them sent a packing, as unworthy to be nam'd. See how great Inconveniencies they must be expos'd to who invent new Methods to distribute the Plants, which will not answer to all their different Textures. Thus

Thus I have finiſh'd what I had briefly to obſerve concerning the ſeveral Methods into which Plants have been reduc'd, which are as many as was neceſſary. Indeed, the ſeveral Ways of diſtributing the Plants has had this good effect, that it may lead the impartial *Botaniſt* ſooner into the more intimate Knowledge of the ſeveral Parts of the Plants, than perhaps he could have been brought to otherwiſe; for as every one ſtrove more particularly to obſerve that part of the Plant by which he reſolv'd to claſs them, than otherwiſe he would have done; and as their different manner of Diſtribution made the Authors of them more particularly obſerve the different Parts of the Plant; ſo whoever ſhall be at Pains to obſerve all the ſeveral Methods, they may come thereby to know more eaſily the ſeveral Parts of the Plants. But as Methods are already ſufficiently multiply'd, I hope none will hereafter give the World the Trouble of multiplying them any more by the Addition of new ones, but that they'll rather chuſe to correct the Deficiency of what is eſtabliſh'd already; for as we have the Claſſing by the Fruit begun by the great Dr. *Moriſon*, improved by the accurate Dr. *Herman*, ſo I hope that moſt accurate, expert, and ſedulous *Botaniſt*, the *Learned* and *Celebrated Dr.* Boerhave ſhall bring it to ſuch Perfection as will be ſatisfactory to all who ſhall hereafter delight in Claſſing the Plants after ſuch a manner. As

the

the Classing by the Flower was begun by *Rivini*, brought to great Perfection by Dr. *Tournefort*, so I hope the Ingenious Mr. *Juisseux* and Mr. *Vaillant* will not be wanting to advance it yet further, by the Improvements they shall make upon it, in doing of which Mr. *Vaillant* informs us he is already in great Forwardness. And for Mr. *Ray*'s Method, which is not so confin'd as the other two, but takes in any other part of the Plant he thought was most certain and least subject to Variation; though it has been of late very considerably amended by himself, yet the often cited *Dillenius* has promised a further Correction of it, for which he seems to be most capable; not only because he's a most expert *Botanist*, but because he seems to have a particular Delight in that Method beyond any other. And for Dr. *Knaut*'s, though it be a Method compendious enough, and well enough made out of *Rivini* and *Tournefort*'s, neither are there unsuitable Observations in it from others; yet since there's enough already beside it, that may be laid aside, and the other three, which are sufficient for the purpose, may serve *ab omni ævo*, for instructing of the young *Botanist*.

BOTANICK ESSAYS.

Essay IV.

Upon the Generation of Plants.

I Have hitherto treated of thoſe Things which more particularly belong to the Plants themſelves, ſuch as the Structure of their Flowers, the Difference of their Fruit, and the ſeveral Methods into which they have been reduc'd by Authors. I am now to diſcourſe of ſuch Things as are common to Plants and Animals, I mean their Generation or Manner of Propagation of the Species, and Nutrition; and as *Theodorus Craanen*,

Craanen, in his *Tractatus Medicophyſicus de Homine*, when he was to treat of the Generation of Animals, expreſſes it, *Jam Colophonem ponemus problemati omnium problematum difficillimo.*

To treat of the Generation of Animals, is what has been eſſay'd by a great many, but few have been able to give that ſatisfactory Account of it which were to be wiſh'd for; far leſs have any yet been able to treat of the Generation of Plants ſo as it ought be; for that which ſtill kept them in the Dark was, 1. That though there were two different Sexes in Animals, by whoſe mutual Aſſiſtance the Species was propagated, yet there was no ſuch Thing known in Plants. 2. That though it can be now made appear, that *omne Animal producitur ab ovo*, and not *à Putredine*, as moſt of the Ancients dreamt the Inſects were; Yet there ſtill remain thoſe who maintain that theſe which they call *imperfect Plants*, are the Product of a certain Rotteneſs in the Earth, as if the infinite Power and Wiſdom of Almighty God were not to be equally manifeſted in the Production of the leaſt Mite, as of the greateſt *Whale* or *Elephant*, or of the *leaſt Muſhroom* as of the *talleſt Cedar*. This Reflection made the Honourable *Robert Boyle* ſay, *That he admir'd Nature's Watches rather than her Clocks.*

When Almighty God created the World, he ſo ordered and diſpos'd of the *Materies Mundi*,

Mundi, that every thing produc'd from it ſhould continue ſo long as the World ſhould ſtand; not that the ſame individual Species ſhould always remain, for they were in proceſs of Time to periſh, decay, and return to the Earth from whence they came; but that *omne ſimile* ſhould produce *ſuum ſimile*. Every Species ſhould produce its own Kind to prevent a final Deſtruction of the Species, or the the Neceſſity of a new Creation, in order to continue the ſame Species upon the Earth, or in the World. For which end he laid down certain Regulations, by which each Species was to be propagated, preſerv'd and ſupported, till in order or Courſe of Time they were to be remov'd hence; for without that, thoſe very Beings which were created at firſt, muſt have continued to the final Diſſolution of all Things, which Almighty God of his infinite Wiſdom did not think fit. But that he might ſtill the more manifeſt his Omnipotence, he ſet all the Engines of his Providence to work, by which one Effect was to produce another by the Means of certain Laws or Rules laid down, for the Propagation, Maintenance, and Support of all created Beings. This his Divine Providence is called *Nature*, and theſe Regulations are called the *Leges Naturæ*, the Laws and Rules of *Nature*, by which every Thing operates in its ordinary Courſe, and whatever recedes from that, is ſaid to be preternatural, miraculous or monſtrous.

Thus

Thus in the third Day the *Earth* was created; *And God said, Let the Earth bring forth Grass, the Herb yielding Seed, and the Fruit-Tree yielding Fruit after his Kind, whose Seed is in it self upon the Earth* [a]. In the fifth Day he created the *Fish* and the *Fowl*, or *Volatiles*, and gave them the Command to be fruitful and multiply [b]. On the sixth he created the *Terrestrial Animals*, such as *Quadrupeds*, *Reptiles* and *Insects*. And last of all, that excellent Fabrick of Man, whom he appointed to be the Lord of, and have the Dominion over all his Fellow Creatures. *So God created Man after his own Image, in the Image of God created he him, Male and Female created he them* [c]. Before this we have no Account of two different Sexes; and its in the next Chapter that we are told, *That the Lord God said, It is not good that Man should be alone, I will make an Help-meet for him* [d]. Now if this Helper had only been granted to Man as a sociable Creature, endow'd with a reasonable Soul, when he had none else to converse with, to comfort and assist him in the ordinary Administration of his Affairs, in the Obedience of God's Commands, to encrease and multiply the Species, and in providing Food and Raiment for him, and those propagated betwixt them, this Necessity of two different Sexes would not have been so

[a] Gen. chap. 1. v. 11. [b] V. 22. [c] V. 27. [d] Ch. 2. 18.

obvious,

obvious, for God Almighty was able to lay down other Rules, and to contrive other Means for the Propagation of the reſt of the created Beings. But ſince all other Species of Animals, as well as Man, have been ordain'd to be propagated by the mutual Concurrence of two different Sexes, that not one of theſe Sexes is able to do that without the other, and that ſuch a manner of Propagation or Production, is *Mundi Incunabilis Coæva*, as Dr *Moriſon* ſays of the Method of *Plants*: This renders ſuch a Neceſſity obvious, *viz.* That no *Species* can be propagated without the Coalition of the two different *Materies* or Subſtances, in order to produce a *Tertium quid*.

I have already ſaid, that *Plants* have a vegetative Life, and that this is common to *Animals* as well as them. That the Propagation or Production of the *Species*, is the effect of the *vegetative*, not the *ſenſitive Life* in *Animals* as well as in *Plants*; and if there be a Neceſſity of the Concurrence of two different Sexes in *Animals*, at the begetting or generating of the Species, the ſame Neceſſity muſt be in the Plants too; for as a *Cow*, a *Mare*, a *Hen*, a *ſhe Reptile*, an *Inſect*, or *Fiſh*, cannot produce an Animal without the Male, no more can we ſuppoſe that a Plant can produce fertile Seed without the Concurrence of the *Male-Plant*, or the *Male Parts* in the Plant. " For " as Mr. *Ray* ſays, that he will not deny that

" Fruit may be produc'd, and even preſerv'd " to Maturity, without the Concurrence of " the *Male Parts* in the Plant; for though " moſt *Birds* do not lay Eggs without " Congreſs with the Male, yet the Hen very " often does it without copulating with the " Cock, but then theſe Eggs are barren, and " Wind-Eggs [a]. Juſt ſo, though a Female " Plant may produce Seed of it ſelf, yet that " Seed is never fertile, as ſhall be ſhewn here- " after".

Sennertus was ſo ſenſible of this, that he wanted nothing but a more intimate Knowledge of the Structure of the Flowers of *Plants* to go into that Opinion, that Plants as well as *Animals*, are *Male* and *Female*, or have *Male* and *Female* Parts, and that without the Concurrence of two different Subſtances or *Materies* flowing from both, or proceeding from the Male, and reſting upon the Female Parts of the *Plant*, no *Seed* can be fecundated or rendred fertile. He therefore puts the Queſtion thus, *An ſemen agat in ſeipſum*, Can a Seed become active of it ſelf? " If, ſays he, there were a " Principle in Seed active for its own Con-

[a] Nonnullas interim tum arbores, tum herbas, fructum proferre & ad maturitatem pervenire abſque mare aut maſculino ſemine aſperſo, non negaverim: Nam & in avibus, quamvis pleræque abſque maris conſortio ova nunquam pariant; aliquæ tamen, v. g. Gallinæ abſque coitu non rarò id faciunt, quamvis ova ſubventania & infœcunda ſint. Raii Præf. ad Syllogen. ſtirp. apud Exteros.

" formation

" formation or Generation, then a Seed could " act within it ſelf; but nothing acts within " it ſelf, becauſe if it acted within it ſelf, it " would be both *agens & patiens actu & po-* " *tentiâ reſpectu ejuſdem*, which, ſays he, is " impoſſible." [a] He ſolves this difficult Propoſition thus: " In all Seeds there are two " different Subſtances, the one tenuious and " ſpirituous, the other groſs and terreſtrious, " or earthy. In the one reſides the active " Virtue, in the other is the paſſive Matter " and Principle. Therefore this active Virtue acts by its ſpirituous Particles upon the " groſſer Part of the Seed, as upon a corporeal Subſtance; upon which Account it is " not one and the ſame Subſtance that acts " within it ſelf, but different Subſtances: Nor " is it with reſpect to the ſame active and paſſive Principle, but in different Reſpects, " which is not abſurd [b]". What a Pity is it

[a] Si in ſemine eſſet principium activum conformationis ſeu generationis, tunc ſemen ageret in ſeipſum: At nihil agit in ſeipſum; quia ſi ageret in ſeipſum eſſet agens & patiens actu & potentiâ reſpectu ejuſdem, quod eſt impoſſibile.

[b] In ſemine eſſe diverſas ſubſtantias, unam tenuem & ſpirituoſam, aliam craſſam & terreſtrem; In illâ reſidere virtutem activam, hanc eſſe materiem & principium paſſivum, & illam virtutem activam ex ſpirituoſâ parte agere in partem ſeminis craſſiorem tanquam in materiem, & hâc ratione unum & idem non agere in ſeipſum ſed in diverſum, nec unum & idem habere rationem principii activi reſpectu ejuſdem, ſed reſpectu diverſorum, quod non eſt abſurdum. Sennert. Tom. 1. Hypomn. 4. Cap. vii. p. 179. Col. 1. Edit. 1642.

that he had no Notion whence this active Principle might proceed, and from what it might flow; since he has such a lively Idea of the Necessity of it, but that he was ignorant of any such Thing as two Sexes in Plants, is plain from what follows: " [a] There are two " Kinds of living Bodies, *Animals* and *Plants*. " In these living Bodies, some have *Sexes*, " and some none. In those which have no " Sexes, the same Seed is sufficient, which is " a Body so elaborated by the Genitor, that " when it is perfected and separated from the " Genitor, it can subsist intire, and with it " the Spirit of the generating Part is trans- " fer'd to the generated; and then the *Tree* " has generated or begot, when it produces

[a] Sunt autem viventium genera duo plantæ & animalia; & enim in viventibus sexus, in aliis non est. In iis quibus sexus non est, unum semen sufficit, quod est corpus ita à generante elaboratum, dispositum, ut ubi perfectum est & à generante separatur, integrum subsistere & cum eo anima generantis in generatum transferri posset: Et tum generat Arbor, cùm producit semen; semen autem hoc animatum esse patet. Et sanè firmissimè sunt rationes, quibus probatur semen plantarum esse animatum: Et enim 1. comparatum est ut à generante separatum & vegetum subsistere possit, quod aliæ partes à plantis avulsæ non faciunt, quæ statim emoriuntur: Deinde quam primum à calore solis, imò etiam ignis, tempore hyberno, in hypocausto fovetur, & idoneam materiem invenit; vel etiam aquam saltem si ea humectet, ut in maltæ ex hordeo confectione pro cerevisiâ coquendâ patet; sese exserere incipit; ac primò radicem protrudit per quem trahit seu recipit alimentum, & corpus plantæ ei simile à quâ decisum est, format. Quæ corporis plantarum formatio non minùs admiranda est, quàm animalium generatio. Ibid. Cap. viii. p. 182. Col. 1.

" the *Seed*, and it is plain that the Seed is " animated——and again. And indeed, there " are moſt prevailing Reaſons to prove, that " the Seeds of Plants are animated; for, " 1. It is obſerv'd, that when ſeparated from " the Mother Plant, being fecundated, it can " ſubſiſt, which other Parts taken from the " Plant, cannot do, for they die immediate- " ly. 2. How ſoon it is cheriſh'd by the " Heat of the Sun, or even by the Fire in a " Stove, and ſhall find convenient Matter " whereby to ſubſiſt; or if it be moiſten'd " with Water, as in the making of Malt of " Barley for the brewing of Ale, it begins to " chit; and firſt of all it puſhes the Root, " by which it attracts and receives the Nou- " riſhment, and forms a Body like unto that " from whence it was ſeparated, which is no " leſs to be admir'd than the Generation of " Animals". He ſays farther, " That there " are two Operations in the Seed, which by " a moſt ſure and certain Way lead us to the " Knowledge of their lurking prolifick Vir- " tue (*animæ Latitantis*) The Conception " and Vivification of the Seed, and afterwards " the Formation of all the Parts neceſſary for " Performance of the Actions of Life; for " firſt, it is manifeſt, that the Seeds, as well " as the Plants, are preſerv'd by their own " Life (*ab animâ ſuâ*) and remain proli- " fick for ſometime, either ſhorter, as for the " ſpace of one or two Years; ſometimes

" longer, as for ſeveral Years, and ſo long as " it is whole and incorrupted, and is put in a " convenient Place, where it may be ſup- " ply'd with a competent Proportion of Heat " and Nouriſhment, it is ready again to grow " up into a Plant of that ſame Species from " whence it proceeded [a]. And again, Al- " though the concoctive Faculty doth not en- " liven the Seed, neither doth it receive ſuch " a lively Diſpoſition from the concoctive

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[a] Sunt autem duæ in ſemine operationes quæ nos ad Latitantis animæ cognitionem certiſſimâ viâ deducunt; ſeminis conceptus, ac vivificatio; & poſteà partium omnium quæ ad vitæ actiones edendas neceſſariæ ſunt efformatio, primò enim quodlibet ſemen, ut in plantis manifeſtum eſt, ab animâ ſuâ conſervatur & aliquamdiu prolificum permanet, aliud breviori, anni ſcil. biennii, aliud etiam plurium annorum pro ſpecierum diverſitate ſpatio: Et quam diù integrum & incorruptum eſt, ac locum idoneum præſens alimentum & calorem externum excitantem nactum, in Plantæ ſuæ ſpeciei creſcere aptum natum eſt. Ibid. Cap. vii. p. 178.

Ideóque & ſi concoctrix facultas ſemen non animat, ut nec in aliis partibus à coctrice facultate eam diſpoſitionem accepit ut poſſit animæ idoneum ſubjectum eſſe, anima tamen quæ eſt in corpore animato ei ſeſe communicat tàm in plantis quàm in animalibus, quod poſtquàm à generante ſeparatum eſt, animæ, quam poſſidet, & à generante accepit, vi & potentiâ novum individuum conſtituere poteſt. Ibid. Cap. ix. p. 187. col. 2.

Dicitur reverà generare arbor vel herba non cùm planta è terrâ creſcit, hæc enim non eſt generatio, ſed Plantæ in actu imperfecto conſtitutæ ad actum perfectum deductio. Ibid. p. 180. col. 1.

Cæterum utitur anima in actione iſtâ corporis conformatione ſubinde ac ſpiritu quæ eſt in ſemine, & ut fœcunda ſemina ſint, facit, & quam diù ſpiritus iſte eſt in ſeminibus, tamdiu eſt anima in ὁικειαύλῃ, quam diù enim ſpiritus iſte evaneſcit, etiam anima in ſemine perdurare non poteſt & ſemina infœcunda fiunt. Ibid. p. 181. col. 1.

" Faculty,

" Faculty, yet it can become a fit Subject " for the Spirit (*anima*). This Spirit which " is in the animated Body, communicates it " ſelf to the Seed or Seminal Matter, as well " in Plants as in Animals, after it is ſeparat- " ed from the Mother-Plant; having now " receiv'd it from the Mother-Plant, and this " Seed or Seminal Matter being in Poſſeſſion " of it, can conſtitute a new individual Spe- " cies, *vi & potentia.*

He proceeds to give his Thoughts concern- ing the Generation, and how this *Anima*, or fecundating Spirit acts upon the Seed. " A " Tree or an Herb is not ſaid to be generated " when the Plant grows from the Earth, for " that is not its Generation, but a Deduction " from an imperfect to a more perfect State.

" The *Anima* diſplays it ſelf in this Action " or Conformation of the Body, by the Spi- " rit which is in the Seed, for ſo long as that " remains, the Seeds are fecundated and ren- " dered fertile; but ſo ſoon as this *Flatus (ut* " *in* οἰκειώλη) this Spirit is evaporated, and " has vaniſh'd, then the (*Anima*) Life can- " not remain, and the Seeds become barren " and infertile.

Thus I hope I have proved, both from the Analogy between Plants and Animals, and from the Sentiments of the learned *Sennertus* (who knew nothing of this modern Opinion of the different Sexes of Plants). That 1. As the Work of Generation in Animals do's not

proceed from their animal or ſenſitive, but from their vegetative Life, which being the ſame as in Plants, that Operation muſt be perform'd after the ſame manner in both. Therefore as there is a Neceſſity of two different Sexes in Animals, it muſt be ſo in Plants too. 2. As paſſive, ſeminal Matter in Female Animals cannot be productive or fertile of it ſelf, without it be impregnated, animated, or its Particles be ſet in Motion, and dilated by the active Principles of the Male, ſeminal Matter: No more can the Female Seed in Plants be rendred fertile, until it is impregnated by the *Farina Fœcundans* from the Male Parts of the Plants.

I proceed to a third, and no leſs convincing Argument, *viz.* The Conſideration of the Flowers. If they were not aſſiſting to, or if there were not ſome extraordinary Uſe for them in the Perfection of the *Seed*, they would not be ſo often obſerv'd upon Plants as they are; but ſince there is no Fruit or Seed without a previous *Flower*; ſince where the one is obvious the other is conſpicuous; and ſince when the one is ſcarce to be obſerv'd by the naked Eye, neither is the other: This implies ſuch a Relation between them, that the one is not to be expected without the other. There may indeed be Flowers upon a Plant, where the Fruit is ſeldom or never ſeen (eſpecially in theſe Northern Climates) ſuch as the *Pervinca*, *Nymphæa alba Minima*, and ſeveral others,

others, where the *Plant* exhausts its nutritious Juice in pushing forth of Tendrills, or upon a running Root, that it is so weakned as not to be able to bring the Fruit to Perfection, as has been observ'd: but there is no Fruit or Seed to be seen, unless there has been a Flower sent as a Messenger before it, to give notice of its approach, though not always upon the same Plant, yet it is still upon some other Plant of the same Species: For the Flowers are to be seen upon distinct Plants, different Branches, or different Parts of the Branch, from the Fruit; as in the *Abies*, *Corylus*, *Nux Juglans*, *&c.* among the *Trees*. *Mercurialis*, *Spinachia*, *&c.* among the *Herbs*. But the Fruit never appears, or never begins to encrease upon these Plants, until the Flower is spent and gone. Therefore they must serve for another Use than either to be merely ornamental, for if that were their principal Use, they would be always conspicuous (*Colore Insignes*) which they are not for the most part in the apetalous Flowers; and they would never be hid, but always to be seen, which they are not, as in *Asarum*, *Epimedium*, *Hydrocotyle*, where though the Flower be large enough in Proportion to the Fruit, yet it is not to be seen unless the Leaf be turn'd up, and both Flower and Fruit be narrowly search-ed for. The *Frumenta* and *Gramina* have their stamineous Flowers, yet in some of them the Flower is seldom to be seen unless you

shake

ſhake the Spike, and then the *Apices* will appear. The *Polypodium*, and other capillary Plants, have *regular Flowers*, which precede the minute *Capſulæ*, or Seed-Veſſels; but neither of them are conſpicuous without a Magnifying-Glaſs. The Fig would ſeem to have no Flower but only a Fruit, yet if you ſhall open a Fig, when it is become pretty big, there are to be ſeen abundance of Flowers regularly diſpos'd, to which ſucceed ſmall Seeds, which as they are not half ſo numerous as their Fore-runners the Flowers, it is reaſonable to conclude the Fig has Male and Female Flowers as well as other Plants.

From what has been ſaid, it is plain that Flowers are not conſtantly a Guard to preſerve the tender *Embryones* from the Injuries of the Air (which is the ſecond principal Uſe aſcribed to them) for then the Flower muſt always have been upon the ſame Pedicle with the Fruit. Since then the Appearance of the Flower is the firſt ſtep towards the Production of the Seed, whether both be upon the ſame Pedicle or not, it neceſſarily follows the one muſt contribute towards the bringing of the other to Perfection.

The Ancients obſerving that ſeveral Plants did produce *Flowers*, and had no Seed, and that other Plants of the ſame Species, and ſown from the ſame *Seed*, did produce the *Seed* without a previous Flower, they were ready to call the one Male and the other Female,

male, without any Notion that the one was aſſiſting to the other, for they look'd upon ſuch Flowers to be only barren; and therefore they call'd theſe which had the Flowers Female, and thoſe which produc'd the Fruit Male-Plants. Thus *Mercurialis* is called *Spicata Fœmina*, and *Teſticulata Mas*; but now *Mutato nomine de te fabula narratur.* That which produces the *Fruit* muſt needs be the *Female*, as it is the *Female Animal* which brings forth the *Fœtus*. Therefore the *Mercurialis Teſticulata* (as it is called) muſt needs be the *Fœmina*, as producing the *Seed*, and the *Spicata* muſt be the *Mas*, whoſe Flower is aſſiſting to the Perfection of the Seed, as ſhall be ſhewn. Where-ever the Plants are annual, theſe with the Flowers, and ſuch as have the Seed are always near to each other, but where the Root is perennial, and where the Plant is more frequently propagated by the Root than the Seed, the caſe alters, becauſe there being no need of the Seed to propagate the Plant, there is the leſs need of the Flower to be nearer to the Plant which produces the Seed. So that we frequently ſee *Bryonia* and *Lupulus* to grow, and the one to produce the *Berry*, the other the *ſquammous Fruit*, when the Plants which produce the *Male-Flowers* of the one or the other are at a great Diſtance; and this is ſo far from being an Objection againſt the Neceſſity of two Sexes in Plants, as well as in Animals;

nimals, that it is an Argument to confirm it; for it ſhews the wonderful Contrivances in order to preſerve the Species, when the ordinary Means of propagating it by the Seed cannot ſo conveniently be obtain'd.

We ſee Animals have a progreſſive Motion, the Male can approach to the Female, as often as is neceſſary for the Work of Generation, or Production of the Species, and therefore there is no other Means of doing it but by the Copulation of the two Sexes; and when there is any Animal ſo created, as to be depriv'd of this progreſſive Motion, then the Organs of both Sexes are obſerv'd to belong to one and the ſame Animal, as is to be ſeen at large in Dr. *Liſter*'s *Exercitations de Limacibus & Cochleis*[a], where he demonſtrates that the *Perwinkles* are *Androgyna*. So that the ſame *Cochlea* partakes both of Male and Female, and that one and the ſame Animal has the Members for Generation peculiar to both Sexes. Whoever wants to be farther ſatisfy'd in that, may conſult his Treatiſe on that Subject. This is what Dr. *Grew* alſo informs us, as ſhall be ſhewn hereafter; and I doubt not but it is ſo in moſt Shell-Fiſh,

[a] Tertia autem cochleæ noſtræ diſſectio erit de organis generationi inſervientibus. Illud verò in Animo ante omnia tenere oportet has beſtiolas *androgynas* eſſe, adeóque unam eandemque cochleam maris & fœminæ participem eſſe & membra generationi dicata utriuſque ſexus in ſe habere. Liſter Exerc. de Cochl. p. 143. c. 21. Lond. 1694.

which

which have no progreſſive Motion, ſuch as *Muſcles*, *Cockles*, *Limpets*, &c. Here we ſee the Species cannot be propagated but by the Coalition of ſomewhat from the Organs of both Sexes. But in Plants it is otherwiſe, as *Sennertus* obſerves [a], which is of great uſe for Preſervation of the Species; for as the Seeds of ſome Plants are of ſo delicate a Texture, that without a due Care they are ſpoilt, and when committed to the Ground, will rot and decay. As they will not chit and ſpring forth in all Soils, or in every Climate, ſo if there were not other Means ordain'd for propagating of the Species, it might decay and be quite loſt: Therefore it is, that ſince the *Male-Plant* of the *Lupulus*, and of the *Bryonia*, are not always near to the *Female*, it is ſo ordain'd that they are propagated by the Root, and ſo there is no ſuch need of the *Seed* of the *Female-Plants* being impregnated by the Male-Flowers, from another Plant of the ſame Species, as in the *Cannabis*, *Mercurialis*, *Spinachia*, &c. where there is no other Means of propagating them but from the Seed.

Theſe being very evident Proofs of a neceſſity of two Sexes in Plants as well as in Animals, I ſhall in the next Place give ſome Ex-

[b] Propterea cùm videamus plantas non ſolùm per radices & exiguum ſalicis, particulam ex radice lupuli & cori abſciſſam in ſimilem plantam excreſcere. ——Sennert. Hypom. 4. Cap. viii. p. 182. col. 1.

periments

periments to confirm this Doctrine in a negative, as I have already done in a positive Way, *i. e.* I shall shew, that when Plants have been depriv'd of their Male-Flowers, or Male Parts in the Flower, they either produc'd no Seed at all, or if they did, they became abortive, dry'd up and dwindled away. Or 3. Though the Seeds did come to Perfection, they were barren and did not produce. And although some who made these Experiments seem to be of Opinion they did not answer Expectation, yet 'tis probable they were mistaken, in not understanding the true Design of such Experiments, nor having due Patience to wait till they should see the Consequence. Therefore I have inserted the Experiments themselves, not only as of moment, but that I may shew how far they who perform'd them have been deficient, in not knowing what to expect, or in not waiting till they should see the the Event, and try if they could procure what was to be expected.

Experiment 1. Mr. *Geoffroy* cut off all the stamineous Tufts of Male-Flowers from the top of the Stalk in the *Mays* or *Turkey Wheat*, so soon as they appear'd, and before the Spike loaded with the *Embryones Seminis* had broke forth *è Foliorum Alis*. Several of these *Embryones*, after they were pretty big, decay'd and dry'd up, but upon other Pedicles, some Grains all along the Spike, swell'd considerably, *Et qui ont parú chargé des germes & par*

par conſequence fæconds, and which ſeem'd to be full of the Bud, and were conſequently fertile, while all the others miſcarried, and there was not one Spike where the whole Seeds did ripen to the full.

This Experiment is a Proof good enough, of the uſe of the *Male-Flowers* in this Plant; for whatever it be that flows from the *Racemi* of theſe *Flowers*, it ſeems it muſt be conducive not only for the Impregnation of the *Seed*, but alſo for the Growth and Increaſe of the *Fruit*. For as we ſhall ſhew hereafter how theſe Seeds are impregnated, ſo what we are to inſiſt upon at preſent is, that what Nouriſhment is uſually furniſh'd to the *Embryones* by the Pedicle, appears not to be capable to dilate or expand it ſelf, nor to contribute to the continual ſupply of nutritious Particles, unleſs the *Embryones* were animated and enlivened by the Spirit, which ſhould have flow'd from the *Male-Flowers*, ſo that they aſcending from the Body of the Plant, towards the *Embryones*, were ſo debilitated and weakened before they could arrive at them, that they which otherwiſe might have ſerv'd for the Augmentation and Increaſe of all the *Embryones* upon the Spike, could now do no more than contribute to the ripening of a few; and although Mr. *Geoffroy* might have imagin'd that theſe few Seeds which came to Perfection were fertile alſo, becauſe they were *charge des germes*; he could not be aſſur'd of

of that, unleſs he had ſown the ſame Seeds next Seaſon, and try'd whether they would chit or not.

There is an uſual Experiment among Gardiners when they buy the Onion or Leek-Seed from thoſe who import them from *Straſburg*, &c. They put a few of the Seeds among Water, mixt with a little Earth in a Pot; and if after a few Days they obſerve them to begin to ſpring or ſend forth the *Folium Seminale*, or Fiber of the Root, then they are capable to judge of the Product; and perhaps not above the third of theſe Seeds will be fertile, though all of them, without this Tryal, may ſeem to be productive enough, being equally full, firm, hard and ſolid; and this Barrenneſs may either proceed by their being too much expos'd to the Air, being ſome time or other too much moiſten'd, and not carefully dry'd after that, by which either *animam ſuam amiſerunt*, according to *Sennertus*'s Opinion, or they had never been impregnated by the Male Parts of the Flower. Now if the Fulneſs, Solidity, and Firmneſs of a Seed, is not a ſure Sign of Fertility, then Mr. *Geoffroy* might have been miſtaken in his Opinion of the Fertility of theſe *Seeds* in the *Mayes*, ſince he did not make any trial of it by committing them to Ground.

He might alſo have been diſappointed in his ſecond Experiment of the *Mercurialis Dioſcoridis*, where he rais'd ſome Stalks which had

had the Fruit, and others which had the ſtamineous Flowers, he remov'd the floriferous Stalks before the Flowers were blown. The Seeds upon the fructiferous Plants miſcarry'd every one, except five or ſix, which were ſo full, that he was perſuaded they were capable to produce new Plants, and ſo did *Camerarius* find in the *Cannabis*; but as neither of them tried the Experiment, by ſowing the ſame Seed the ſecond Year, they were not ſure but they might have fail'd in their Expectation. 'Tis true, Mr. *Geoffroy* ſays it's probable the *Farina* had flow'd from the *Mayes* before he was aware, and that the *Farina* of the Flowers might have flow'd from another Place of the Garden *, and ſo have impregnated the Seeds of the *Mercurialis*; but whether it was ſo or not, he could never be certain as to the effect of his Experiments, without ſowing theſe Seeds a ſecond Year, as is ſaid.

The curious and inquiſitive Mr. *Richard Bradly*, R. S. S. † informs us, that he took twelve Tulips, planted them in a ſeparate Place of the Garden, remote from any other Tulips, and depriv'd them of their *Apices* immediately after they were blown. Not one of them produc'd either Fruit or Seed

* Memoires del Academie Royal des Sciences pour L'an. 1711. p. 194.

† *New Improvements of Gardening*, &c. *Pt.* 1. *page* 20.

that Year, though none of the Four hundred which were in a Bed in another Place of the ſame Garden, fail'd to produce both abundantly. This, from a Perſon of his Exactneſs, may be rely'd on, and is very convincing, as being *ex αὐτοψία*. He alſo adviſes to take off the Male Flowers from the Cucumbers, and they ſhall produce no Fruit, and the Katkins from the Wallnut, Philbeard, and Hazle-Nuts, and their *Embryones* ſhall fall ſo ſoon as they begin to appear. It is not eaſy to have the Experiment duly perform'd with the Trees, becauſe the Duſt may blow, and be convey'd to the *Embryones* before one is aware. It may be eaſily try'd with the Tulips. As for the Cucumbers, their Flowers uſually blow very ſoon after the Plant is come to any ſuitable Bigneſs, and ſo frequently in the Seaſon, that they require great Exactneſs.

If one has a mind to try any ſuch Experiment, take two Pots full of Earth, ſow ſome Spinage-Seeds in each; place them at a good Diſtance from each other, and when the Male Plants of the one begin to appear, which is eaſily diſcern'd by the Spike, remove them before any of the Flowers are blown in one of the Pots. For the other Pot, let both the Male and Female-Plants grow promiſcuouſly. If the Pot where the Male-Plants have been remov'd, ſhall contain any Female Plants which produce Seed, let the Seeds be carefully kept ſeparately, both of ſuch Plants where the Male-

Plants

Plants were preſerv'd, and where they were remov'd, and ſow both of them afterwards, ſo ſoon as the Seaſon will permit; and you may then ſee whether the Seeds from both will be fertile or not.

Mr. *Jacob Bobart*, Overſeer of the Phyſick Garden at *Oxford*, about thirty eight Years ago, which was before the Doctrine of the different Sexes of Plants was well underſtood, Herboriſing in the Country, obſerv'd a Plant of the *Lychnis Sylveſtris ſimplex*, whoſe *Flowers*, though they had *Stamina*, yet there were no *Apices*; and finding this not in one, but in all the Flowers upon the ſame Plant, this made him imagine it might be a new Species, and therefore he mark'd the Plant, and took care to have it preſerv'd till the Seeds were ripe; and he at length procur'd them full hard and firm, and to outward Appearance *Remplis des germe* (as Mr. *Geoffroy* has it). He fail'd not to ſow them in his Garden next Seaſon in a proper Place, but there was never a Plant wich ſprung up.

I had this Account from the Celebrated Dr. *Sherard*, at whoſe deſire I have inſerted it, and both of them being Perſons of ſuch Eſteem, and ſo good Credit, I may venture to ſay it ſets the Opinion of the different Sexes of Plants upon another Footing than it is receiv'd by moſt of our modern Authors; for this imports that it is not the Nouriſhment of the groſs Subſtance of the Seed it ſelf, which

is hereby meant, nor the Increaſe of the Seed-Veſſel, which is thereby deſign'd, for as is obſerv'd, a Hen can lay an Egg without previous Congreſs with the Cock, and this ſhall be the ſame for Colour, Taſte, (when new-laid) Smell, Bigneſs with another Egg which has been cock'd (as they call it) *i. e.* That has been fecundated by the *Materies Seminalis Maſculina*; but the Difference appears when both are put under the Hen to be hatch'd, the one ſhall pullulate or chit, and the other ſhall become fetid and rot. Its juſt the ſame with the Seed of a Plant, it may be augmented, and encreaſe in its *Moles*, it may become firm, hard and ſolid, and have all the Tokens of a perfect Ripeneſs; the Seed-Veſſels may be enlarg'd, and the Pulp or *Parenchyma* of the Fruit be augmented; and yet the Particles of the Seed may remain crude, undigeſted, and uncapable to be explicated and dilated, or ſet in a ſuitable Motion, whereby to protrude the *Fibrilla* of the Root at the one end, and *Folia Seminalia* at the other, unleſs it has previouſly receiv'd ſome extraneous Matter, or ſome active Particles from the Male Parts of the Flower, or from the Male-Flower it ſelf; no more than the Point in a Compaſs can tend towards the North-Pole before the Needle has been touch'd with the Load-ſtone; and this is that which is call'd the *Animatum ſemen* by *Sennertus*, when by the Means of the more active Principles from the

the Male-Flowers, the groſs Parts, or paſſive Principles of the Seed, are animated and rendred capable to extricate themſelves, and be ſet in Motion by the Fomes of the Earth, when committed to it. I ſhall not pretend that the *Folia Seminalia* are not form'd in the Seed, whether it has been fecundated by the *Farina* or not, for the certainty of that depends upon the Inſpection, which I recommend to others to make, having no preſent Opportunity to do it; nor ſhall I deny but both the *Seed-Veſſel*, *Fruit* and *Seed* may encreaſe and be augmented to the full without it, for that appears to have been in the caſe of Mr. *Geoffroy*'s Experiment; but as we find that only a few Seeds came to a convenient Bigneſs, it ſeems the *Farina Fœcundans* is aſſiſting in that too, both by the frequent Abortions in the Seeds of the *Turkey* Wheat without it, and by the frequent Alterations the Female Bodies of Animals undergo, after they are impregnated by the Male, ſuch as a Dilation of the *Uterus*, and increaſe of its Thickneſs, proportionable to the Weight of the *Fœtus*, the adventitious *Navel-String*, *Chorion*, *Amnios*, *Placenta*, *Cotylidones*, *&c.* all which are the Conſequence of this Impregnation, which is evident, if upon no other Account, by their being *Ejectamenta* after the *Partus*, whereof more hereafter.

To conclude the Neceſſity of two Sexes of Plants, as well as in Animals, I have

only this familiar Obſervation to add, That the Fertility or Barrenneſs of any Tree in the more or leſs fruitful Seaſons, can be known to ignorant and leſs curious Perſons, by the quantity of the *Flowers* which appears in the Spring-time, and that not in the Trees alone, where the Flower and the Fruit are upon one and the ſame Pedicle, but in ſuch Trees alſo where the Flowers are upon diſtinct Trees, or ſeparate Places upon the Tree; for by the quantity of the *Katkins* or *Juli* upon the *Walnut*, *Filbeard*, or *Hazle* Trees, 'tis eaſy to determine whether ſuch and ſuch Trees ſhall be fertile or barren for the enſuing Seaſon, before any of the *Embryones* begin to break, be puſh'd forth or appear. I am ſenſible it may be objected, that the ſame fruitful or unfruitful Seaſon may produce both equally. So that the one is not the Cauſe and the other the Effect, but both Effects proceed from the ſame Cauſe, *viz.* the ſeaſonableneſs of the Winter or Spring; but then, if it is a windy Winter, rather than a windy Spring, and that moſt of the *Juli* are blown off before they either diſperſe their Duſt, or the *Embryones* break forth. If after this there ſhall be a Scarcity of theſe Nuts, my Argument will hold good, and if any will be at Pains to obſerve it, they'll find the Truth of what I aſſert.

In the firſt *Eſſay*, I diſcours'd of both the *Male* and *Female* Parts of the *Flowers*. I come

come now to describe their use in this Place. It is not unfit that Flowers in this respect be divided into that of *Male Flowers*; these were formerly (as is observ'd) reputed barren, and the Plants which produc'd them were also called *Female Plants*, because having no Notion of any different Sexes in Plants, they called them *Female* upon the account of their Weakness; or if they had any thought of Sexes in them, it was only allusive: Thus in *Mercurialis*, *Cannabis*, *Spinachia*, those Plants which are now called the Females, were by them reputed Male-Plants, because their Seeds resemble the *Testes*, and therefore they were called *Testiculatæ sive Mares*, as is said. The *Lupulus*, because its Flowers resemble those of the *Cannabis Fœmina* (as it was call'd) is also called *Lupulus Fœmina*, whereas both should be called *Mares*. The Ancients were ignorant of those called at present *Hermophrodite* Flowers, they had no true Notion of the Sexes of Plants, so they could not imagine that the Parts of both Sexes should be in one Flower, upon one and the same Pedicle. *Androgynous* or *Hermaphrodite Animals*, bear the least Proportion in the Animal Kingdom; but the *Hermaphrodites* have the greatest Share in the Vegetable, though they are not so numerous as they have been suppos'd; for upon strict Examination it will be found, that a great many more Plants have distinct Male and Female-Flowers than was formerly be-

liev'd. I have discovered several this Summer, as shall be shewn.

Having thus demonstrated the Necessity of different Sexes in Plants, and that the Female-Seed, though it should ripen to the full, cannot be fertile, unless impregnated by what it receives from the Male Parts of the Flowers, I come next to explain the Organs of Generation in both Sexes. In the *Animal OEconomy*, beside those Vessels destinated for Nutrition, and for the Secretion of the several Juices in the Body; there are these called the *Spermatick Vessels*, or *Vasa Generationi inservientia*. They consist of the *Præparantia*, *Deferentia*, and *Continentia Semen*. The *præparantia in Males* are the Blood-Vessels and the *Testes*, the one convey the Blood, and the other separates the *Semen* from the Blood, and elaborates it. In Plants again there are Vessels which receive the nutritious Particles from the Earth, and convey it to the Extremities of the Plant, whereof some tend directly to the Leaf, and others to the Flower. These which go to the Pedicle of the *Flower*, may properly be called *Spermatick Vessels*, for it is from them that the *Seminal Particles* in *Male*, *Female*, and *Hermaphrodite Flowers* are separated. Therefore the Pedicles of the *Hermaphrodite Flowers* are proportionally grosser than those of either the *Male* or *Female*, they have a double Office, and contribute successively to both. In those where

where the *Calix* becomes the Fruit, the greateſt Supply is furniſh'd to it firſt, and diſtributed in its cortical Part. Thus we ſee the Pedicle is ſo far enlarg'd at firſt in the Roſe, that it is of an equal Bigneſs with the Bud. After the *Calix* is thus form'd, the next Diſtribution is to the inner or centrical Part of the Flower, call'd by Dr. *Grew* the *Attire*; and where the *Piſtillum* becomes the *Fruit*, the *Piſtillum* and *Stylus* is form'd at the ſame Time with the *Stamina* and the *Apices*.

The *Stylus* at the very firſt, acquires both its due Length and Bigneſs, for the nutritious Particles aſcending in the Center, never ſtop till the *Stylus* is ſtretch'd out to its full Length; and in ſuch as are furniſh'd with a peculiar *Apex*, that is firſt form'd; the Neck of the *Stylus* or that part next to it, is the biggeſt, from thence it gradually decreaſes in its Groſsneſs, till it comes to the *Piſtillum*. This is eaſily obſervable by thoſe who will be at Pains to open the Bud of the Lillies, Tulips, *&c.* before they are half blown, *Eſſay* 1. p. 31.

The *Stamen* is next furniſh'd with an extraordinary Supply of the nutritious Particles before the Flower is blown. Theſe, whether fewer or more, are at the firſt brought to their proportional Largeneſs, being round and Juicy, *Eſſay* 1. p. 24

The *Apex* is the third which receives this extraordinary Supply of Nouriſhment, for after the *Stylus* is form'd, that it may lean

to

to it after the Veſſels of the *Stamen* are extended to their full Length, and ſo form'd that they can convey ſuch an extraordinary Quantity of Particles as may fill up the Capacity of the *Apex*, it is then more enlarg'd than ever hereafter; for if you ſhall open the Flower of a Lilly before it is blown, you ſhall find the *Apex* is fully as long as the *Stamen*, for as the one half of the *Apex* covers the *Stamen* fix'd to its Center, ſo its other half is ſo far extended above the *Stamen*, as the *Stamen* remain'd uncover'd below it towards the Pedicle, *Eſſay* 1. p. 26.

The *Petala* are the fourth which receive this extraordinary Supply of Nouriſhment before the blowing. Theſe upon the reverſe are firſt enlarg'd towards the Pedicle, and are afterwards extended and ſtretch'd forth in proportion to the Enlargement of the *Attire*; they are all firſt groſſer, and more ſucculent towards their *Ungues* or Origine, becoming gradually thinner and broader. In the *monopetalous Flowers*, the *Stamina*, for the moſt part ariſe from the *Petalon* it ſelf, but in the *polypetalous*, they ariſe partly from the *Petala*, and partly from the *Calix*; eſpecially if the *Stamen* correſpond in Number to the *Petala*, as in the *Hexapetalæ*, or *Polypetalæ Liliaceæ* of *Tournefort*, where every *Stamen* ariſes oppoſite to the middle of the *Petalon*, partly from the *Calix*, as is ſaid, *Eſſay* 1. p. 15.

This

This Obſervation (how and when this more than ordinary Supply of Nouriſhment is conciliated to the Flowers) eaſily demonſtrates wherein the Analogy of the *Organs* of *Generation* in Plants and in *Animals* conſiſts. In *Animals* the *Seminal Matter* is receiv'd by proper Veſſels from the ſame Blood from whence the other Secretions fit for the Preſervation of the *Animal OEconomy* proceed; ſo that the Blood in *Animals* being the ſame with the *Sap* in *Plants*, and both being convey'd after the ſame manner throughout the ſeveral Bodies, as ſhall be ſhewn, it neceſſarily follows the one as well as the other muſt have proper *Veſſels* for Secretion of the *Seminal Matter*.

Let us conſider then that the *Sap*, or *nutritious Juice* aſcends in common to the Pedicle of the Flower, as the Blood flows by the *Aorta Deſcendens*, and that at the *Calix* or bottom of the Flower, ſome ſhare goes to one part of it, and ſome to another, as the *Aorta* ſends one Branch to the *Spermatick-Veſſels*, and the remainder of it goes to perform the other Functions; And as a part of the Sap is ſeparated by the Pedicle of the Flower, when the remainder is diſtributed throughout the remaining Parts of the Plant, ſo the *Arteria Præparans* goes directly to the *Teſtes* in the *Male* and *Ovarium* in the *Female*, and in Flowers, ſome Veſſels tend directly to the *Calix* (if it becomes the Fruit) or to the *Perianthium*

rianthium (if there is any) ſome to the *Petala*, ſome to the *Stamina*, and ſome to the *Piſtillum* or *Uterus*, as *Malpighi* juſtly calls it; and whereas in the Trunck of the Pedicle, the Veſſels conveying the Sap were large, undivided, now when they are to form divers Subſtances, out of one and the ſame nutritious Juice, theſe common Trunks muſt be divided, and the Capacity of each proper Veſſel muſt be vaſtly diminiſhed; ſo that what Liquor is tranſmitted by them, muſt be rendred moſt tenuious and ſubtile. And as we ſee how in the wonderful Intricacy, innumerable Circumvolutions, prodigious Length, and unfathomable long tenuious Duct of all the *Tubuli*, the Seminal Matter muſt paſs throughout the *Teſtes* and *Epididymides*, before it can arrive at the *Vaſa Deferentia*, in order to be convey'd to the *Veſiculæ Seminales*; ſo the Sap, as it paſſes from the Pedicle, muſt enter the moſt tenuious *Tubuli*, where the groſſer part cannot be admitted; from thence ſome muſt go to the *Petalon* (in monopetalous Flowers) whoſe tender and delicate Texture is obvious to exceed the Subſtance of the Pedicle or *Calix*. Here again it muſt enter a ſecond Time into *Tubuli* finer than theſe, *viz.* into the *Stamina*, where the *Tubuli* being ſtill finer than thoſe of the Pedicle *Calix*, or *Petalon*, the Particles convey'd by them, muſt be rendred very ſubtile, by the frequent Stops or Hindrances, for the groſſer Particles to aſcend along with

with them, and ſo they aſcend by parallel Ducts to the *Apex*, where this ſubtile Matter is retain'd, till it be farther elaborated by the Evaporations of the more humid and aqueous Particles, by the Heat of the Sun, and then it becomes a moſt ſubtile, fine, impalpable Duſt, which is then ſaid to be ripe.

If we ſhall but ſeriouſly reflect on theſe Things, we muſt needs conclude, 1. That the ſame due Care being taken to elaborate and prepare the moſt ſubtile and impenetrable Particles of the nutritious Juice in Plants, as of the Blood in Animals: This Subſtance, 2. ſo prepar'd, as it muſt be deſign'd for ſome extraordinary Uſe, ſo this Uſe can be no other than that of being the means of fecundating the Female Seed in Plants, as the other is of the *Ova Fœminea* in Animals. And therefore to make good the Analogy, we ſhall compare the aſcendent Veſſels in the principal Trunk and Branches, to the *Aorta*, that Divarication towards the Pedicle, to the *Arteria Spermatica*. Thoſe minute Tubes which convey the Sap from the Pedicle to the *Stamina*, eſpecially if they paſs through the *Petalon*, to the *Teſtes*, becauſe their Capacity is greatly diminſh'd, as I have obſerv'd; and the *Stamina* themſelves to the *Vaſa Deferentia*, becauſe they convey the Particles thus elaborated to the *Apex*, which I compare to the *Veſiculæ Seminales*, which contains this Seminal Matter thus prepar'd, until it is farther

farther elaborated, as is said, and until it can be conveniently discharg'd. There is no need of *Vasa Ejaculatoria* here, nor of a *Penis*, because, as in Fish there is no Emission of the one, and for want of a progressive Motion there can be use no for the other, so that *oportet ut Farina avolet in auras*.

But least what I have here asserted should be look'd upon as *gratis dictum*, I desire any one to take a Flower new blown, and pull one of the *Stamina* from the Pedicle or *Petalon*, and there they'll find a tough, viscid Liquor, like to the *Sperma*, which here remains till its more subtile Particles have either ascended the *Stamen*, or perhaps the more gross Particles might have remain'd there after the more subtile had ascended, before the Flower was blown. In the Lillies this is as plain and demonstrable as can be; and there is a Contrivance more obvious upon that account in the Orange-Lilly, and most of the *Martagon* Lillies, which I had the Opportunity first to observe in the Garden of that most expert Gardiner, Mr. *Thomas Fairchild* at *Hoxton*. It is a Tube running along the *Petalon*, a little below the middle (*bbb*) towards its Origine or *Unguis*. The beginning of this Tube is opposite to the Origine of the *Stamen*, as it arises from the Pedicle, whose Use, as I take it, seems either to give access to so much Air concentrated within so small a Bounds as may serve to attenuate and rarify this viscid Liquor

Liquor ſtill remaining at the Root of the *Stamen*, thereby to render it more capable to aſcend, or for receiving ſo much Dew or Rain from the Firmament, as diluting its Viſcoſity at the Root of the *Stamen*, it may thereby the more eaſily emit its volatile Particles, which penetrating into the *Tubuli* of the *Stamen*, they may from thence aſcend to the *Apex*. There ſeems alſo to be a third Uſe, which is to receive and contain the ripe *Farina*, as it falls from the *Apex*, but of that more hereafter. Though I am not poſitive theſe are the true Uſes of this hollow Tube, yet I am willing to entertain ſuch Thoughts of them until more probable be ſhewn me. But that the Juice is ſo viſcid in this flat *Flower* is plain; and that this Viſcidity is uſeful in ſuch Caſes, is alſo plain from ſome other Examples I ſhall produce, ſuch as, 1. In the Imperial Crown, which always hangs downward, at the Origine of each *Petalon*; and near to the Origine of the *Stamen*, there is a *Pelvis* or Baſon, which contains this viſcid Liquor [a], which though its Mouth is downward, yet the Juice will not exceed its Bounds until the *Petalon* dry up; and I doubt not if it were ſooner remov'd, but the Fructification may be hinder'd [b]. This Viſcidity is yet more obvious in the Pompions, wherein the *Male-Flower* upon the top of the *Pedicle (a)*, [c] there is a Cavity full of this Li-

[a] Tab. 1. Fig. 4, 6. [b] Ibid. Fig. 12. (*b*). [c] Tab. ii. Fig. 5.

quor,

quor, cover'd by the lower part of the *Pistillum* (*b*), which as an *Alembeck* is plac'd over it, where, by the Heat of the Sun, it is rarify'd, receiv'd into the parallel *Tubuli*, by which it is convey'd to the top, and so makes up the *Materies* of the *Farina*; and least by the too great an Abundance of the Liquor in the Cavity, and too great Heat, it should be pent up and choak'd, there are two Holes (*c c*), for transmitting so much of the Air as is capable to assist the Heat in the Rarification, and further the ascent of this viscid Liquor.

These Examples, I think, are sufficient to demonstrate, that a proper Liquor is separated by peculiar, secretory Ducts or Vessels from the Pedicle, and convey'd to the *Stamina*, where it is rarify'd, and ascends so as to make up the *Materies* of the *Farina* in the *Apex*; and these *Apices* being fill'd before the Flower is blown, it plainly shews that it is necessary there be some *Apparatus* prepar'd for furthering or being assisting to the Fructification after the Flower is blown; for no sooner do the *Petala* expand themselves, and the more humid Particles are evaporated by the heat of the Sun, than the *Apices* themselves immediately burst, and shed the *Farina quaquaversum*. Now if there was no Necessity for the *Farina* in this Case, why such haste to elaborate this viscid Liquor? Why are the *Apices* fill'd before the Flower is blown? And why

why do's it ſhed the Duſt immediately after the Flower is blown? Do's not all this portend that the *Farina* muſt be of ſome Extraordinary and ſpecial Uſe towards the Fructification? Therefore I cannot enough admire why ſo accurate a *Botaniſt*, and ſo acute a Wit as Dr. *Tournefort*, who was not only a moſt exact obſerver of the Flowers himſelf, but, to his immortal Praiſe be it ſpoken, was the firſt who ſet the true Method of obſerving them on a right Footing; and yet that he ſhould ſhut his Eyes from ſo demonſtrable a Truth, "and aſcribe no other Uſe to this *Farina*, "than that it was a mere Excrement [a], to "call the *Stamina*, *vaſa excretoria*, for the "ſuperfluous Humours (*inepti humoris partibus*) and the *Apices* the Receptacles of "ſuch Particles as were unfit for Nouriſhment, and that the *Petala* did perfect the "Nouriſhment, like the Bowels, to the growing Fruit, *&c.*" Whatever is unfit for Nouriſhment, ſuperfluous or excrementitious, is thrown out or ſet a-part in the Bowels of animal Bodies after the nutritious Particles are

[a] Petala. 1, 2, 3, 4, 5, 6. (Tab. 1. Iconum Tournefort.) alimentum à pediculo acceptum viſceris inſtar perficiunt fructui innaſcenti, 8, ſuppeditant inepti humoris partibus per ſtamina ſeu vaſa excretoria, 9, 10, 11, 12, 13, 14. apices 1. receptacula 15. 16, 17, 18, 19, 20. ——— Diximus jam apices, quicquid minus apti continent, alimentum in ſe recipere eorumque valvas à congeſtis alimentis deduci. Tournefort Iſagoge in Rem. Herb. p. 69, 70.

ſeparated; but here the Particles are ſeparated and depoſited in the *Apex*, as ſoon, or rather ſooner than the Nutrition of the Fruit is begun, 2. Excrementitious Particles are the more groſs and terreſtrious part of the nutritious Juice, and uſually are thrown downwards and deſcend by their own Gravity; the Particles on the *Apex*, on the contrary, are the more ſubtile, volatile, and the firſt that aſcend. And 3. The *Petala* can never ſupply the Nouriſhment to the Fruit, becauſe they themſelves are ſupply'd by the proper Veſſels, and it's the Pedicle that furniſhes it equally to both, as their different Exigencies require, though there were always *Petala* along with the Fruit, and though both Flower and Fruit were always upon the ſame Stalk, as it's known they are not, and therefore as *Craanen* ſays of his beloved *des Cartes*, I may ſay of the great Dr. *Tournefort*.

Quod pace boni viri dictum ſit, tamen hic erravit,

Mr. *Vaillant* hugs himſelf with a great deal of Facetiouſneſs and Delight, when he reflects after what manner the Flower of the *Parietaria* ſheds its Duſt; "So oft as it happens, "ſays he, that the Male and Female Parts "are in the ſame Flower; the Extenſion and "Swelling of the Maſculine Organs is per-"form'd ſo ſuddenly, that the Lobes of the

"*Apex*,

" *Apex*, yielding to their Force, do expand " themſelves with a ſurprizing and wonderful " Celerity; at that moment theſe luſtful *Ge-* " *nius*'s think of nothing ſo ardently as to ſa- " tisfie their Lechery; for they no ſooner " find themſelves at liberty, than they make " a brisk and vigorous diſcharge of the *Fari-* " *na*, which carries the Fecundity along with " it every where, and by a ſtrange Commo- " tion is all at once ſo weakned, that the mo- " ment it obtains Life it procures its Death: " Neither does the Scene terminate here; " ſcarce is this Venereal Sport at an end, " when the Lips of the Flowers unite and join " together, with the ſame Celerity that they " were ſeparated, and recover their former " Poſture; ſo that one would ſcarce imagine " they had ſuffered any Violence, unleſs they " were preſent to ſee it; or that there were " ſome Remains to be obſerv'd, after ſuch " violent Tranſports, which ſtill continue up- " on the Field of Battle.

" All this Mechaniſm is to be obſerv'd in " the *Parietaria*, if it be view'd in the Morn- " ing, when theſe Parts of the two Sexes do " ſport and play; but if this fail to be volun- " tarily perform'd, touch but one of the *Api-* " *ces* with the Point of a Pin, and if arriv'd " at a competent Age, you ſhall ſee how the " *Stamen*, formerly crumbled and wrap'd up, " does all of a ſudden extend it ſelf, and diſ-

" cover how these amorous Embraces are per-
" form'd within *.

* Quoties autem accideret, ut in eâdem stirpe flores gerantur simul, quorum hi fœminina tantum, illi autem masculina & fœminina conjuncta, organa cingunt, arrectio, tumorque organorum masculinorum in hisce tam subitò contingit, ut lobuli gemmæ flosculosæ cedant illorum impetui, atque hinc inde semet expandant mirabili meherculè velocitate. Etenim eodem hocce momento libidinosa hæc ingenia nihil ardentiùs cogitant, nisi ut violentos luxuriei affectus expleant, neque citiùs libera se & expedita experiuntur, quin extemplò quàm vehementissimè fœcundam explodant, omnemque uno impetu ejaculentur, genituram, diffusâ nimirum pulverulentâ nubeculâ spargente quaquaversùm fœcundationem arvi genitalis. Verùm, quàm rara, quàm mira, catastrophe! ipso hoc fœcundandi ardore adeò semet exhausta dolent, ut ipso, quo prolem vitâ donant, momento sibimet mortem parant præsentissimam!

Neque vel hîc tamen Scena clauditur. Quid ergo? Vix venereus hic lusus absolutus est, quin ilicò florum labia, aut lobuli, ad se invicem accedant eodem quidem, quo à se mutuò recesserant, celeritatis impetu, veteremque ita formam statim renovent. Ita quidem, ut difficillimum foret credere, flores hosce ullam vim passos esse, nisi vel ipse actum hunc vidisset oculus, vel adhuc cerneret caduca sceleta magnanimorum heroum, qui hanc pugnaverant pugnam; clara quippe hæc gestæ fortiter rei monumenta supersunt aliquamdiu erecta in campo conflictûs, aut Aplustrium instar Jocularios experiuntur lusus volitantis Zephyri.

Apparatum huncce artificiosum facilè spectare datur in parietariâ. Sed accedas oportet horâ sacrâ Veneri! Aurora est, quæ favet & adspirat diversorum in plantis sexuum voluptatibus, congressibusque; ubi verò agere fortè renuunt satis opportunè ex voto Tui observantis, cogere vel sic poteris, aciculæ apice leniter modò stimules. Si enim matura jam hisce ætas lusibus, opus tantum erit quàm blandissimè unum elevare lobulorum, statimque spectaculo quàm jucundissimo oblectaberis; filamenta quippe, vel manubria staminum ex arcuato hactenus incurvoque flexu in erectum arriguntur situm, ut vi acta violentâ; tumque liquidò spectatur singulare quodque & tectum, quod in exercitio hocce peragitur venereo. Vaillant Sermo de Florum Structurâ. pag. 9.

This I have also observ'd, with much Pleasure, to happen in a Morning to the Mulberry Tree, when the four *Stamina* within each proper *Perianthium* of the *Julus*, being crumbled and wrap'd up like a Scrue, as in the *Parietaria*, are extended and darted forth with inexpressible Velocity, dispersing the Dust every where, which appears like so much Smoke all round the Tree about the time of Sun Rising, or before nine a-Clock, with this Difference, that whereas in the *Parietaria*, after the *Farina* is dispers'd, the *Perianthium*, which now becomes the *Capsula*, is immediately shut, in order to preserve the tender *Embryo Seminis*, and contain it till it be ripe; whereas there being no Seed in the *Perianthium* of the *Morus*, it remains an empty Vessel after the *Farina* is dispers'd; nor is it unpleasant to observe, how every one of the *Globuli* of the *aggregate* Fruit in the *Morus* has two hairy Tufts to stop the *Farina* in its Motion, that it may remain there 'till it has communicated its prolifick Virtue: but of this more hereafter.

As the due Consideration of these things seem sufficient to convince us of the Necessity of two Sexes in Plants; so by what follows, I hope it will more fully appear. Since I have compar'd the *Pistillum* of the *Pompions* to an *Alembick*, it will not be improper to observe, that all the *Seminal Matter* in Plants, whether *Male* or *Female*, does ascend from

the *Pedicle* after the same manner; for as in Distillation, all the more spirituous and subtile Particles ascend first, and then the more gross and aqueous: Therefore these wrapp'd up *Stamina* may not be unfitly compar'd to the *Serpentine*, us'd in rectifying of the Spirit of Wine; for when the Particles of the *Farina* ascend, it is still farther elaborated by the Contortions and Windings in the *Stamen*.

Thus we see how many Convolutions there are in the *Tubuli Seminiferi* in the *Testes*, thro' which the *Semen Masculinum* must pass, before it can be duly elaborated; and as I shall observe, that Plants, Trees especially, have an annual and a perennial Surface, and that how soon this annual Surface, such as the Leaves, the Flowers and the Fruit in the *Autumn* is gone, the Extremities of the *Tubuli*, which convey Nourishment to them, collapse, so that no more Sap can pass that way, which makes the Leaves, *&c.* dry up, and the Fruit to fall off, as the *Urachus* which arises from the bottom of the Bladder; the Root of the Umbilical Vessels in the Liver and *Ductus Botalli*, or *Foramen Ovale* in the Lungs, collapse and decrease into Ligaments after the *Fœtus* is born, there being then no more use for them. So in this case, as the *Stamina* and *Apices*, after they are empty'd of the *Farina*, decrease, there being no more use for it, so the *Pistillum* or *Calix* do augment; and as the more subtile Parts have already ascended by the *Stamina*, so the more gross

groſs Parts remaining, are diſtributed in a larger Quantity to the Seed-Veſſel, in order to form it, and afterwards to nouriſh the Seed contain'd in it by Means of the proper *Placenta* belonging to each Seed; ſo that the Seed being made up of the more groſs and terreſtrious Part, this alone is ſufficient to convince how neceſſary it is there be a more ſubtile, active Principle, to quicken, enliven, and diſpoſe this groſs Subſtance of the Seed to Fertility, by ſetting its Particles in ſuch a Motion, as they may be further attenuated, dilated, extended, and be rendred capable to admit of a ſuitable Supply of nutritious Particles from the Earth, when committed to it; as much as a Hen-Egg has need of the *Ovi aer*, as *Bellini* terms it, from the *Cock*, in order to diſpoſe the *Cicatricula* in the Egg to be dilated, the *Lineaments* of the *Chicken* to be form'd, and the *Chicken* it ſelf to be hatch'd.

The Female Parts of the Flower come next to be conſider'd; and theſe are either the *Calix*, when it becomes the Fruit, or the *Stylus* and *Piſtillum*, when this laſt becomes the Fruit. The fertile *Calix*, as I have obſerv'd, is known by the Enlargement of the Pedicle at the bottom of the Flower, after the *Tubuli nutritivi* have diſpers'd the groſſer Particles for its formation, while the more ſubtile were diſtributed among the *Apices Staminum*, as in the *Roſe*. There is a ſecond Secretion, of more tenuious and ſubtile Particles, from the

groſſer *Tubuli*, which nouriſh'd the *Calix*, to the more ſubtile, which nouriſh the Seed; ſo that, however, the Seed is compos'd of groſſer Matter than the *Farina* in the *Apices*, yet its Particles are ſtill more tenuious and ſubtile than either the *Calix* or *Capſula*. This is obvious to our coarſe Taſte, as well as by its other Effects, by which the Seeds excell either the Seed-Veſſel or Pulp of the Fruit. I'm credibly inform'd, that the pounded Stones of the Raiſins at the diſtilling of Brandy from the fermented Maſs, which remain'd after the vinous Juice has been trode out from it in the Fat, yields much more Spirit than when that Maſs has been fermented without bruiſing or pounding of them; and the ſtrongeſt Cyder is made when ſpecial Care has been taken to bruiſe the Seeds of the Apples at the making of Cyder; and every one is ſenſible, that the beſt Cherry-Brandy is made when the Seeds or Kernels have been bruis'd along with the Black-Cherries. This, with the more aromatick Taſte in all Seeds of Stone, or pulpous and parenchymatous Fruits, is ſufficient to ſhew that the Seeds are compos'd of more ſubtile Particles than the Fruit it ſelf, though not ſo as the *Farina*, by reaſon of the later Aſcent of its Particles, as is ſaid.

I have obſerv'd, that the *Stylus* receives its extraordinary Growth and Encreaſe, at the ſame Time with the *Stamina* and *Apices*, i. e. before the Flower is blown, and from

that

that Time it decreaſes and collapſes with them. It is true, ſo ſoon as the Flower opens it encreaſes as to its Length, but then it becomes ſmaller. The Conſideration of theſe Things move me to have another Idea of its Uſe than I formerly entertain'd, and quite different from thoſe aſcrib'd to it by others, of which I ſhall diſcourſe at more length hereafter. When I reflect on the one hand, that before the Flower is blown, it is ſtill longer than the *Stamina* with their *Apices*, that where-ever there are but few of the *Stamina*, and their *Apices* are at firſt heavy loaded; the *Stylus*, though ſhorter, yet it is thicker and ſtronger, and has for the moſt part a Button, or proper *Apex* at its Extremity, which being bigger than the *Stylus* it ſelf, becomes a curb to prevent the *Apices* from exceeding in their due Bounds, as to the Length, and ſerves as a Prop, Stay, or Support, upon which they may lean (*un pivot*) as the *French* ſay, by which they are kept in their due Situation, and ſo are preſerved from injuring and cruſhing one another, which by their own Weight they muſt needs do, were it not for ſuch a Contrivance to prevent that Inconveniency. Whoever will open the Flower of a Lilly before it is blown, ſhall find the *Apices* in ſuch a Situation round the *Stylus*, as will eaſily demonſtrate this; and it is yet more plain in the *Granadilla* or *Paſſion-Flower*; for before it is blown, all the fore part of the *Apices* (4.4.4.) lean upon the tripartite

tripartite *Stylus*, which is then erect, divided into three Branches (3.3.3.) each having a Button at the Extremity, to prevent the *Apices* from mounting higher, and to keep them firm in their Posture. No sooner do you remove any of the *Petala* (2.1.1.) before it has begun to open of its own accord, than the three Branches begin to expand themselves with a strong Elasticity, and being separated from each other, acquire a flat, or Horizontal Position, forcing the *Apices* from them, which then agreeably turn round of their own accord; and that Surface which was towards the three *Styli*, and was then the fore-part (so to call it) becomes now its lower part, inclining towards the expanded *Petala*, and dispersing the *Farina* towards their Center and Origine. I was once of the Opinion that the use of the *Stylus* might be to transmit such a Proportion of Air as might serve to inflate the *Capsulæ* or Seed-Vessels, wherein the Seeds are lodg'd, because they are usually form'd and empty before the Seeds begin to swell and increase; but when I considered on the other hand, that this requires a hollow *Stylus*, and that there are very few, perceptibly such, I could not think that was its chief Use; for the Use of any part of a Plant or Animal, must be general, and hold in all; which this do's not; for though, as in the *Stamina*, its Fi-

* Tab. III. Fig. 3.

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bers may be parallel, yet in moſt of the *Styli* the Cavity of its *Tubuli* is as little perceptible as that of the Nerves of all Animals. 2. That would invert the Nature of the Thing, as ſhall be ſhewn; for its plain that both the Vapours and Juice of Plants aſcend; nor can the Juice deſcend by the ſame *Tubulus* in the Circulation, no more than our Blood can aſcend and return by the ſame Artery; ſo that when any Vapour aſcends from a Plant, the Wind cannot deſcend by the ſame Veſſel, I mean in ſuch a Quantity as to inflate or enlarge the Cavity of a Seed-Veſſel. The ſecond Uſe then of the *Stylus*, it's probable, may be to keep the *Piſtillum* at its bottom, firm in its Place, leaſt it be diſtorted by the Load of the *Apices*, and Number of *Stamina* which ſurround it. Another Example of this may be ſeen in the *Hypericon*, which being tricapſular, has a tripartite *Stylus*, upon which the *Stamina* leans before the Flower is blown, by which they are kept from crowding and diſturbing the tender *Fructûs Rudimentum*; but when it opens, they tend obliquely outwards, making the *Stamina* incline outwards alſo. That theſe two are the true Uſes of the *Stylus*, may be farther proved by its decaying much about the ſame time with the *Stamina* and *Apices*; for when the *Apices* are empty'd, they become lighter, and conſequently need nothing to ſupport them, when the groſſer Particles aſcend in greater Quantity to make up the *Capſula*, ſo that from an

Embryo

Embryo it now becomes a *Fœtus*, and so strong as to be able to exist of it self, without any further Support. The *Stylus* being thus depriv'd of so large Support of Nourishment as it had formerly, by the swelling of the *Pistillum*; and being compos'd of more subtile Matter, alike with the *Stamina* and *Apices*, that evaporating, and no other ascending to supply its Place, it must needs dwindle away and decay of Course.

Having thus describ'd the Organs of Generation in both Sexes of Plants, it may be enquir'd how two inanimate Bodies fix'd to a proper Place, and often at a good Distance from each other, can so unite that the Male must conciliate somewhat to the Female Parts, before the Seed can be impregnated? This Difficulty has been partly solv'd already, and shall be farther clear'd up by what follows. Its proper I should at present give the Origine and Progress of this Doctrine, the Opinion of several Authors concerning it, and add my own Observations, after an exact Examination of several Flowers to confirm the whole.

Dr. *Nehemiah Grew*, some time an Eminent and Learned Fellow of the Royal Society, is acknowledg'd by all to have been the first who discovered the Use of the *Farina* in the *Apices*. He ingenuously owns Sir *Thomas Millington*, *Savilian* Professor at *Oxford*, to have been the first who gave him the Hint of it; for he told him, *That the Attire doth serve*

ſerve as the Male, for the Generation of the Seed.

In purſuance of this Dr. *Grew* propoſes, *That in regard every Plant is* ἀρρενοθηλυς *or* Male *and* Female, *it ſerveth for the Separation of ſome Parts, as well as the Affuſion of others. The ſum therefore of his Thoughts concerning this matter is, That in the* Seed-like Attire, *the ſeveral* Thecæ *are like ſo many* little Teſticles, *and the* Globulets, *and other ſmall Particles upon the* Blade *or* Penis (*the* Stamina *and* Capillamenta) *and in the* Thecæ (Apices) *are as the vegetable* Sperm, *which ſo ſoon as the* Penis *is exerted (the* Stamina *are emptied) or the* Teſticulæ (Apices) *come to break, falls down upon the Seed-Caſe or* Womb (Piſtillum *or* Calix) *and ſo touches it with a prolifick Virtue.*

And that theſe Particles only, by falling on the Uterus, *ſhould communicate to it, or the Sap therein, a prolifick Virtue, it may ſeem the more credible, from the manner wherein Coition is made by ſome Animals; as by many Birds, where there is no intromiſſion but only an Adoſculation of the Parts, and ſo in many Fiſhes. Neither in others doth the* Penis *ever enter any further than the Neck of the* Womb; *nor doth perhaps the* Semen *it ſelf, or if it doth, it can by no Means be thought bodily, or as to its groſs Subſtance, to enter the Membranes, in which every*

every Conception, or the Liquor intended for it, before any Coition is involv'd, but only ſome ſubtile and vivifick Effluvia, *to which the viſible Body of the* Semen *is but a vehicle: And the like* Effluvia *may be very eaſily affus'd from the above ſaid Particles into the Seed-Caſe or Womb of a Plant* [a].

Thus far that ingenious Author, from whoſe Writings I doubt not but the Celebrated Mr. *John Ray* has taken the *Innuendo's* to convince him of the ſame Opinion; for upon all Occaſions he inſiſts, "That the *Stamina* and "their *Apices*, are not idle and ſuperfluous "Parts, but moſt profitable and neceſſary. In *Synopſ. Stirp. Brit.* That moſt valuable Treatiſe he ſays, *Hinc etiam confirmatur ſententia opinantium pulverem in Apicibus Staminum contentum Spermatis maſculini vicem præſtare* [b]. In his *Sylloge Stirpium extra Britannias*, he ſays, "1. That *God* and *Na*"*ture*, or the ordinary Miniſters of his Will "to perform his Pleaſure, never doth any "thing in vain. 2. The *Flowers* of Plants "may want their ornamental Part, ſuch as "the *Petala*, but they never want the *A*"*pices* [c].

His Obſervation in this is ſo juſt, that I can add, as there are ſeveral Plants which want ſome Part or other of the conſtituent

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[a] *Anatomy of Plants*, Book iv. Ch. v. p. 172. [b] P. 52 [c] *Præfat.*

Parts

Parts of the *Flowers*; but there is no Plant which wants the *Apices*, or some Means to contain the Dust or *Farina* till it is ripe, of which the *Viscum* is a pregnant Instance, where the *Perianthium* and *Petala* are so united, that they cannot be separated without Disruption of the Fibers which pass betwixt them, where is neither *Calix*, *Pistillum*, nor *Stamina*; and where the Dust in minute Globules is spread over the inner Surface of the *Petala*, like a yellowish Powder, not unfitly compar'd to the *Flores Sulphuris* by Dr. *Tournefort*. This Dust, when ripe, becomes blackish, and then the Flower falls off altogether, and is either driven by the Wind, or the Dust is blown from it towards the *Embryones*, which are in separate Branches, or separate Plants of that Species. A most accurate and exact Description of that singular Plant, is shortly to be expected from that *Curious Anatomist*, the *expert* and *sedulous* Dr. *James Dowglass*, R. S. S. Mr. *Ray* continues 3. That all the juliferous Trees produce the Flowers early in the Spring, and the Dust is ripe before the *Embryones* appear. " 4. The *Apices* are hollow, and contain the " *Globuli* of the Dust in their Cavity. 5. The " Female *Palma dactylifera* do's not fructify " unless the Male be planted, and the Dust " is sprinkled upon it, when they would have " it become more fertile, otherwise as *Prosper Alpinus* observes, If the *Ægyptians* fail

" to

6

" to do this, the *Female* Tree either will " produce no *Fruit* at all, or if it did, the " *Fruit* would either abort or miſcarry, or " never ripen. He do's not deny but both " Trees and Herbs may produce *Fruit* which " may ripen; but he compares ſuch Fruit or " Seed to a Wind-Egg, as has been obſerv'd. " From all which he concludes that theſe " *Apices* are the principal Parts of the Flow- " er, ſince they contain the Duſt, which in " his Opinion is analogous to the Animal- " Maſculine Sperm, endow'd with a proli- " fick Virtue, and inſtrumental in fecundating " the Seed". Thus far that Learned and Inquiſitive, natural Hiſtorian, who confirms what I have advanced concerning Mr. *Bobart*'s Experiment of the *Lychnis*, *viz.* That the Seeds may ripen and come to Maturity, and yet be barren, unleſs fecundated by the *Farina*.

Rodolphus Jacobus Camerarius, *Tubingenſis* Profeſſor, in his *Letter de Sexu Plantarum* [a], is ſo juſt to theſe two *Britiſh* Lights, that having ſeriouſly conſidered the Opinion of the two Sexes of Plants, ſo often deny'd by the Ancients, he acknowledges he was convinc'd of the Truth, by reading of what Dr. *Grew* and Mr. *Ray* had ſaid upon the Subject, to whom he attributes the Honour of ſo valuable a Diſcovery; and taking particular No-

[a] Edit. Tubingæ, 1694.

tice

tice of what Mr. *Ray* had advanc'd concerning Animals, where he says, " He knows " no kind of *Animal* whose *Penis* enters " the *Ovarium*, and for the most part it do's " not enter the *Uterus* it self; for only a " *Halitus* and *subtile Effluvia* are sufficient " to fecundate the *Ova*, and to enliven the " enclos'd *Embryo*. *Camerarius* concludes, " That since all the *Apices* of *Flowers*, what- " ever regard they may have to the *Styli*, " are so adapted as to disperse the Dust upon " them, since Nature evidently demonstrates, " that a superficial Touch of the *Uterus* and " *Ovum*, is sufficient for *Fecundation*, who " can deny that this wandring *Dust* is desti- " nated for *fecundating* the *Seeds* in *Plants*.

What Dr. *Grew* and Mr. *Ray* had writ upon this Subject, was neglected, and like to be forgot, had not that learned Fellow of the Royal Society, Mr. *Samuel Morland*, revived it; but he is more positive concerning the manner of this *Fecundation*, than *Camerarius*, who though he favours the Notion about the *Stylus* being the means of Conveyance very much, yet he concludes, as to that, *Non nostrum tantas componere Lites*. For Mr. *Morland* establishes a new and unheard of Opinion concerning it. His Words are

" But the admirable Dr. *Grew*, to whose " Industry and happy Sagacity we are in- " debted for the best Improvement of this " part of Knowledge, is the only Author I

" find, who hath obſerv'd that the *Farina*, " or fine Powder which is at its proper Sea- " ſon ſhed out of thoſe *Thecæ* or *Apices Se-* " *miniformes*, which grow at the top of the " *Stamina*, doth ſome way perform the Of- " fice of the Male Sperm. But herein I think " he falls ſhort, in that he ſuppoſes them on- " ly to drop upon the out-ſide of the *Ute-* " *rus* or *Vaſculum Seminale*, and to impreg- " nate the included *Seed* by ſome ſpirituous " Emanation, or energetical Impreſs [a].

Upon which he makes this Query, " Whe- " ther it be not more proper to ſuppoſe, that " the Seeds which come up in their proper " *Involucra*, are at firſt like unimpregnated " *Ova* of *Animals*". That this *Farina* is a Congeries of *Seminal Plants*, one of which MUST be convey'd into every *Ovum* before it can become prolifick: That the *Stylus* in Mr. *Ray*'s Language, the upper part of the *Piſtillum* in *Tournefort*'s, is a *Tube* deſign'd to convey theſe *Seminal Plants* into their Neſt in the *Ova*: That there is ſo vaſt a Proviſion made, becauſe of the Odds there are, whether one of ſo many ſhall ever find its way into, and through ſo narrow a Conveyance.

Mr. Geoffroy, *Member of the Royal Academy of Sciences at* Paris, being inſtructed by the *Fellows of the Royal Society*; and *Ca-*

[a] *Philoſoph. Tranſact. No.* 287. *p.* 1474.

merarius

merarius, though he neither acknowledges it, nor mentions them, yet sums up their Opinions thus,

" 1. That the Dust being wholly sulphureous, and full of subtile, penetrating Particles, as is evident by its odoriferous smell, " Falls upon the *Pistillum*, where it remains, " and that the more subtile Particles penetrate the *Pistillum* and young Fruit, where " they excite a Fermentation capable to disengage the young Plant, shut up in the " *Embryo* of the *Seed*. For it is believ'd " by this Opinion, that the *Embryo* contains " the young Plant (which is to spring forth) " wrap'd up, and that it wants a proper Juice " to disintangle it, and make it grow. This he has from Dr. *Grew*.

" 2. That the *Farina* is so many first *Germina*, or Buds of the Plant, which have " only need of a proper Juice in the *Embryones* to be nourish'd and encreas'd therein, as the Animals have need of an *Egg* " or *Uterus*, to hatch and bring them forth. " This he says has so much the better Foundation, because there is not the least Appearance of the *Germen* by the finest Microscope in the *Embryo*, before the *Flower* is decay'd, and that the *Apices* have " shed the *Dust*; and these are not only unobservable in the *Embryones Seminum*, but " they are not to be found in the Seeds themselves upon Examination, after they are

" pretty well advanc'd, and the Bud become " pretty visible, if it has not been fecunda- " ted by the *Farina*[a].

The Opinion is Mr. *Morland*'s, and the Experiment is *Camerarius*'s, contain'd in his following Paragraph, but too long to be inserted, concerning a Microscopical Observation made upon the Progress and Encrease of the Seed in a leguminous Plant, perform'd by *Camerarius*, and translated Word for Word from the *Latin* into *French*, by Mr. *Geoffroy*. Neither doth it so much confirm this second Opinion; for if all requir'd by it be to shew the Prevalency of the *Farina* for fecundating the Seed, that can be granted by the Favourers of Dr. *Grew*'s as well as Mr. *Morland*'s Opinion; but if by it is meant the Entrance of the *Farina* into the *Embryo*, this Experiment neither shews that, nor proves the Conveyance.

The curious and inquisitive Mr. *Richard Bradley*, R. S. S. was the next who in order of Time has given his Opinion in this Matter, his Words are, in making use of the Lilly for an Example; " That the Male-Seed of the " Plant is convey'd from the *Stamen* to be per- " fected in the *Apex*, where, by the Sun's " Heat it ripens, and bursts forth in very mi- " nute Particles, like Dust, some Particles of

[a] Memoire del Academie Royal des Sciences pour L'an 1711. p. 297.

" which Powder falling upon the Orifice of " the *Stylus*, is *either* convey'd from thence " to the Utricle, *or*, by its magnetick Vir- " tue, draws the Nouriſhment with greater " Force from the Parts of the Plant into the " *Embryo's* of the Fruit, and makes them " ſwell. *Improvements of Gardening*, &c. He makes uſe of Mr. *Morland's* Examples of the Lilly and *Corona Imperialis*, but finding the entry of the *Farina* into the *Piſtillum* has ſome Difficulty, he uſes the alternative, *or by its magnetick Virtue*, &c.

As I ſhall enquire into the Validity of theſe Examples hereafter, ſo I beg leave to tell Mr. *Bradly* in the interim, that there is no need of having recourſe to Attraction, ſince the ordinary Circulation of the Juice of the Plant, and ſuch a Dilatation of the *Tubuli* which convey it, as is requiſite, will do the thing, without *drawing the Nouriſhment with greater Force*. Nor do's the magnetick Virtue in the *Bees-Wax* confirm the Opinion; for what is viſcous, ſuch as *Roſin*, *Terebinthina Cocta*, and harder Bodies, as *Amber*; and a Glaſs *Tube* or *Cylinder*, if rub'd till it is warm, have that drawing Quality as well as *Bees-Wax*.

The laſt who I find has treated upon this Subject, is *Sebaſtian Vaillant*, a noted *Botaniſt*, Demonſtrator of the Plants in the Royal Garden at *Paris*. He in a Diſcourſe upon the tenth of *June* 1717, concerning the *Structure* and *Difference* of Flowers, being of dif-

ferent Sentiments from the last three, makes the following Supposition.

" Granting there were such Conduits, and " that it were possible for each Grain of the " Dust to enter the Capacity of the *Ovaries*, " shall we therefore be persuaded, that each " Grain is predestined to enter its proper " *Ovum* before any other: Can they pe- " netrate into so many *Ova*, when the whole " *Ovarium* has but one Cavity? *v. g.* In the " *Primula Veris*, where the *Ova* are as it " were indented into the *Placenta*, situated " in the *Ovarium*, much after the same man- " ner as the *Fructus Alkekengi* is in the *Vesi-* " *ca*, or as the Socket which contains the " Candle in a Lanthorn. In that case one of " the two must happen, either the Shell of " the *Ovarium* must be broke, that the *Em-* " *bryo* may get in, or by making a loug *Tour* " or *Route*, it must creep in betwixt the Eggs, " penetrate the *Placenta* to pass that way, and so enter the *Ova*. Are these Ways natu- " ral, or are they practicable?

I have now given the Sentiments of seven different Authors upon that Subject, in their own Words, lest it should be said I had wrest- ed the Sense, or misapply'd their Meaning: and being resolv'd to obey the *Motto* of the *Royal Society*, NULLIUS IN VERBA, I shall im- partially give my own Sentiments at last, without becoming a Party-Man so far as to sub- scribe to this or t'other Sentiment, because such

ſuch an one has advanced it, but by an exact Examination of the Flowers themſelves, ſhall endeavour to find out which of theſe two Opinions, ſo diametrically oppoſite to each other, are moſt conſonant to matter of Fact.

But before I begin, I muſt lay down this general Maxim, which I hope none will deny, *viz.* That Nature is uniform in all her Operations, and never recedes from thoſe Rules laid down by the wiſe Diſpoſer of all Things at the Creation, by performing the ſame Thing after two different and contrary Methods; therefore, if the *Farina* be a *Congeries* of Seminal Plants in one Species, it muſt be ſo in all. If there be an open and direct Paſſage; or though not ſo direct, yet if by any indirect Paſſage, by which it can be demonſtrated one ſingle Grain of the *Farina* can enter every individual Seed in one Plant, it muſt be ſo in all; but if neither of theſe hold good; and if it can be prov'd by ocular Inſpection, without the Aſſiſtance of a Microſcope, in thoſe very Plants exemplify'd by Mr. *Morland*, Mr. *Geoffroy*, and Mr. *Bradley*, that the *Farina in Subſtantia* cannot enter the *Vaſculum Seminale*, or if it do, that there is no direct Paſſage for it to enter each particular Seed, after it has ſo got into the *Capſula* or *Siliqua*; then I hope both their Queries, Suppoſitions and Aſſertions muſt fall; and if this is plainly demonſtrated in Plants, then the late ſo univerſally receiv'd

Opinion, that the *Animalcula* in *Semine Masculino*, is that which by its Entry into the *Ovum Fœmineum* becomes the *Fœtus*, must fall to the Ground too, because of the *Analogy* I have prov'd to be betwixt Plants and Animals.

Mr. *Morland*'s first Example is of the *Corona Imperialis*, whose Flower hangs downwards. I shall not deny but its *Stylus* may be hollow all the Way, and that it may be open at the Extremity also, for I never observ'd it with an intent of examining it narrowly; but by its Situation, and several other Circumstances, it do's not seem to favour this Opinion.

For, 1. As in Animal Bodies there is a continual Efflux of Particles through the Pores of the Skin, it is so in Vegetables also, as appears by the immediate fading of Flowers, or any other part of a Plant after being pluck'd off, which proceeds from the Evaporation of the Particles in the *Tubuli*, without any more succeeding to supply their Place. Now it is as reasonable to suppose that these Particles flow out by the hollow *Stylus* as by any other part, and more sensibly there than elsewhere, because of being concentrated within so narrow Bounds. Now if these Particles descend by the *Stylus*, hanging downward, the Particles, or rather Grains of the *Farina* can never ascend that same Way. 2. Granting that these Grains did ascend by the *Stylus*, how do they get into the *Vasculum Seminale*?

nale? Every one who will but obſerve it may ſee that's cloſely ſhut up. There is a *Paries intergerinus*, a Partition-Wall betwixt them; for though the *Stylus* is plac'd upon the *Piſtillum*, it is ſeldom or never one continu'd Body with, but a diſtinct Body join'd to it, 3. Mr. *Morland* ſeems to contradict himſelf, *when he ſuppoſes the Rain either waſhes it, or the Wind ſhakes it down the* Tube *till it reach the* Vaſculum Seminale. (N. B. *He traces it no farther*) For that Extremity which is the upper part of the *Stylus* in an erect *Flower*, muſt be the lower in a dependent one; ſo that the Rain or Wind, if either have acceſs to it, muſt rather waſh or drive it away from the *Vaſculum Seminale*, which is now above the *Stylus*. I heartily join with him, that the *Pinguid Villi* at the Extremity of the *Stylus*, may be plac'd there to catch and detain the *Farina* as it flies out of the *Thecæ* [a]. This is what Mr. *Bradly* obſerves, when he ſays [b], "We may eaſily "conceive that the glutinous Matter and "Velvet Covering on the Extremity of the "*Piſtils*, may be capable of receiving and "holding ſome of the Powder as it falls; "and whether the Immiſſion of the *Farina* "*Fœcundans* be requiſite or not, its Lodg-"ment on the Mouth of the *Piſtillum*, may, "by virtue of its attractive Quality, per-

[a] *Tranſact.* N°. 287. *p.* 1475. [b] *Improvement of Planting*, &c. *p.* 19.

"haps

" haps fecundate the Seed contain'd in the *V-*
" *terus*. I go ſo far in with Mr. *Bradly* in the alternative (tho' denying the attractive Quality; for the Lévity and natural Propenſity of ſuch ſubtile Particles to aſcend, is ſufficient here) that I ſhall put him in Mind of another Contrivance for that purpoſe, of which I doubt not he is already ſenſible, *viz.* of the *Pelvis* (ſo to call it) or Ciſtern ſituated at the Root or Origine of each *Petalon* (*a*) *Fig.* 12. *Tab.* 1. fill'd with a viſcous Liquor (*b*), which continues there, and never exceeds its Bounds ſo long as the *Petalon* is in Health; *for ſince the* Apices *are here ſo artfully fix'd, that they turn every Way with the leaſt Wind*, as Mr. *Morland* juſtly obſerves, when they burſt, and the *Farina* is driven to and fro, though it cannot ſo eaſily enter the narrow Tube, yet it may be conveniently blown up towards the Origine of the *Petala*, ſurrounding the *Stylus*, where it is ſtop'd or ſtaid by this Viſcoſity till it has perform'd its Office. Mr. *Fairchild* being perſuaded that this viſcous Liquor did ſome way or other contribute towards the fructifying of this Plant, but not being ſenſible how it did it, tried the Experiment of wiping it off ſo ſoon as it was depoſited in the *Pelvis*, and the Flower ſo ſerv'd did not fructify, or had no ſucceeding Fruit. The way I account for that is, the Humidity being remov'd, the *Farina* is no ſooner blown upwards, than it immediately falls down, without

out furniſhing any Effect; and that which confirms this is, becauſe both Tulips and Fritillaries frequently have this *Pelvis* or Baſon, yet it is for the moſt part dry and empty, becauſe their Flowers being erect, eſpecially the former, they have no ſuch need of this Liquor to retain the Duſt; for the Rain having immediate acceſs to them, may waſh the Duſt towards the Origine of the *Petala*, where it can remain till it has done its Work: whereas the Rain having no acceſs to the inner Surface of the Flower of the *Corona Imperialis*, it is naturally endow'd with this Humidity depoſited there by ſeveral excretory Ducts, in order to render it fit for the purpoſe. See *Malpighi Anatome Plantarum*, dedicated to the *Royal Society*, where he takes notice of this Singularity in this Flower, but aſcribes no ſuch uſe to it.

The *Lillies* are the next Examples propos'd, both by Mr. *Morland* and Mr. *Bradly*. In Mr. *Morland*'s Figure of the yellow Lilly, he repreſents it to have the *Apices* (*bbbbbb*) to be equally high with the top of the *Stylus* A, and the *Petala* to over-lap each other. I'm ſorry his Engraver ſhould have ſo far impos'd upon the Publick; for by what, upon narrow Inſpection, I ever could obſerve, the top of the *Apices*, before the *Lilly* opens (they being then perpendicularly ſituated,) reaches no higher than the Neck of the *Button* upon the top of the *Stylus*; and this

this is before the *Apices* begin to burſt and ſhed the Duſt; but no ſooner do's the *Flower* begin to open than they depart from the *Stylus*, and by a certain Elaſticity force the *Petala* outward, and to expand themſelves. This done, they immediately change their Poſture from perpendicular, to oblique or horiſontal; nor do they ever pour out their Duſt until they can conveniently drop it upon the bottom of the *Flower*, and towards the Root of the *Piſtillum*.

But granting it were ſo, the top of the *Stylus* (which I call the *Button*, in Contradiſtinction to the *Apices Staminum*) (*aaa*) [a] *Fig.* 1, 2, 3. *Tab.* 1. is ſo compact, and of ſo firm a Subſtance, that its next to impoſſible that the *Farina* in Subſtance, or in *Partibus integris*, can paſs through it. If the *Partes integræ*, the compleat Grain, the *minute Globuli*, in which is contain'd the whole *Seminal Plant*, cannot then enter, the *Totum Compoſitum*, muſt be diſſolv'd, and the *minute*, *Seminal Particles* in this ſmall *Grain* of *Duſt* muſt be diſunited; and how ſhall theſe again come to cement ſo as to make up one continued Body? Or how ſhall this *Corpuſculum*, ſo united, penetrate a ſecond Time the Partition-Wall, betwixt the *Stylus* and *Piſtillum*? And in the third Place, how ſhall it find out its way to its Neſt in the proper *Embryo*

[a] *Tranſact.* 287. *Fig.* 23. *p.* 1479.

Seminis?

Seminis? Let them anſwer the Queſtion who can.

The *Lilium Album* has indeed its *Petala*, which over-lap each other, *Fig.* 1. Their inner Surface is ſo viſcous, that the Rain will not wet them, no more than if they had been rub'd over with Oil. Here the *Farina* falls towards the bottom of the *Flower* in great Abundance; it is moſt fragrant, and the *Apices* (*bb*,*i*) are longer than thoſe of any other Lilly. The *Stylus* (*n*) is ſo far from being adapted to receive the *Farina*, that it is always bended upwards, when the Flower is expanded, and as it were flies from the *Apices*, which by this Time rather incline downward.

The *Petala* of the two Orange-Lillies, *Fig.* 2, 3, are ſo far from over-lapping each other, that there is a diſtance betwixt each of them at their Origines (which perſuades me that there muſt be an Error *Typographi*) rather than Deſign in Mr. *Morland*'s Explication of the Figures, *p.* 1479. and *yellow* muſt be put there inſtead of *white*. This Diſtance betwixt the *Petala* is ſo great, that if it were not for certain *Villi* or Hairs interſpers'd upon their inner Surface, and inclining obliquely upwards, the *Farina* would be in Hazard of being loſt (*aaa*) *Fig.* 4. The Abſence of theſe *Villi* in the *white Lilly*, and their being ſo plentiful upon the other two, denotes ſome ſpecial Uſe in them more than in the other; and I can think

think of none more probable than that of retaining the *Farina*, *Fig.* 3. The *Apices* (*c*, *f*, *g*) seldom reach much higher than the *Pistillum*, so far is the *Stylus* in it from being adapted to receive the *Farina*. I was one of the first who discover'd this to be a distinct Species. Every one of the *Petala* in both the *Orange-Lillies*, have a longitudinal *Tube*, *Fig.* 4. reaching from a little below the middle (*b*) downwards (*c*) to the *Unguis* or Origine (*d*) where it arises from the Pedicle. We have spoke to its Use already.

The *Martagon Lilly*, *Fig.* 5, 6. hangs downwards. Here the *Apices are so artfully fixed also, that they may turn every way with the least Wind*, so that the *Farina* is easily blown upwards, since all the *Petala* are reflex, contrary to what is in the *Imperial Crown*. The bottom of the Flower (so I call it because of its Situation) or the Origine, is always cover'd with a Viscosity. The Button is hard and solid, and has Grains of the Dust affix'd to it; not what it receiv'd from the *Apices*, but the result of the Particles which ascend by the *Tubuli* (for before it is blown it is erect) and naturally burst forth from it self; so far is the *Farina* here from being capable to enter the *Stylus*, and ascend to the *Vasculum Seminale*. The *Stylus* is indeed hollow in all the *Lillies*, especially the *Orange* or *yellow ones* (*b*) *Fig.* 3. But as the solid *Button* hinders or stops the entry

to

to the *Farina*, &c. I ſuppoſe it to be ſo to render it the more Light, for if it had been ſolid of that Largeneſs, it would have been too heavy, and apt to cruſh the tender *Piſtillum* before it was well form'd; for, as is obſerv'd, the *Stylus* uſually acquires its full Bigneſs before the *Piſtillum* can well ſupport it.

The *Iris* is a moſt pregnant Inſtance that the *Farina* cannot ſo much as come at the *Piſtillum*, for having ſix *Petala*, *Fig.* 7. the three *Stamina* with long *Apices* lie hid between the three Down-Falls or *Petala*, which hang downwards (111) *Fig.* 8. and three large Expanſions of the bifid *Stylus* (2) *Fig.* 9. and the upper part of the Down-fall (3). The *Farina* can never reach the Center of the *Stylus* (3) *Fig.* 8. though it were hollow, which it is not, but muſt deſcend along its out-ſide, to the top and out-ſide of the *Fructûs Rudimentum*, there to emit its *Effluvia*.

The *Malva*, *Fig.* 10, 11. is another pregnant Inſtance. This has a *Tubus Paramidalis Staminibus onuſtus Piſtillum excipiens*, as *Tournefort* expreſſes it. The *Stylus* called *Piſtillum* by *Tournefort*, is lodg'd in a *Pyramidal Tube* (*ddd*) *Fig.* 10. ſo fully loaded with *Stamina* and *Apices* as it can hold. All theſe ſhed their Duſt outwards, which muſt fall down upon the bottom of the *Flower*, and none of it can enter the Cavity of the *Stylus*; but ſuppoſing it did, the *Piſtillum*

or *Fructûs Rudimentum* being lodg'd at the bottom of the *Tubus* (*b*) *Fig.* 10. and the *Capsulæ* being adherent to the *Stylus* (*f*), if the Grain of the Dust did fall down to the bottom of the *Stylus*, it must again pierce it perhaps thirty or forty Times in the *Malva Rosea*, opposite to each of the *Embryones Seminis* in the *Fructus Rudimentum Stylum rotatim cingens*, of which there's no *Vestigia*.

But there's another Plant with a *Mallow-Flower*, which has a capsular Fruit, and the same *Tubus* with the *Stamina* and *Apices*, bending outwards, called *Ketmia*, or *Alcæa Arborescens*, *J. B.* which because its *Stylus* (*g*) *Fig.* 10. is plac'd upon the top of the *Capsula*, it is therefore solid, and ending in four Buttons, which so shut the hollow Tube, that its impossible for any of the *Farina* to enter it. All these Flowers are viscid at the bottom, so as to retain the *Farina* which falls upon it, until it has emitted its *Effluvia*.

Arum has a thick, gross, solid *Stylus*, round whose lower part are plac'd the small *Globuli*, which afterwards become so many *Berries* as to make up the *Fructus Coacervatus*. The *Stamina* loaded with the *Apices*, or the *Apices* without any *Stamina*, are situated round the same *Stylus*, about the *Embryones*, that the *Farina* may fall upon them; but there is no Means of conveying it into their inner Substance.

These

These are such Examples as are sufficient to prove that the *Farina* cannot enter the *Stylus*, penetrate into the *Pistillum* or inner part of the *Vasculum Seminale*, nor have the least access to the *Embryones Seminis*. I shall in the next Place shew several other wonderful Contrivances for retaining the *Farina* at the bottom of the Flower, on the outside of the *Vasculum Seminale*, till it has emitted the *Effluvia*. *Campanula*, *Fig.* 1. *Tab.* 4. has five *Stamina* and *Apices* (*ccccc*). *Chamenerion*, and *Lysimachia siliquosa hirsuta*, *magno Flore*, which is another Species of the *Chamenerion*, as *Tournefort* well observes, have each of them eight *Stamina*, *Fig.* 2. *No.* 1, 2. of which *No.* 2. has 4 *Stamina* longer (*bbbb*), and four shorter (*gggg*), with a quadripartite *Stylus* at the top. All these have their *Stamina* bended outwards towards the bottom, forming an empty Space round the *Stylus*, for the *Farina* to lodge in (*dd*) *Fig.* 1. The *Stylus* at the top is never enlarg'd till the *Stamina* are separated from it, and bended downward.

Onagra, or *Lysimachia corniculata*, has its *Stylus* about one Inch and a half long, enclos'd within a *Vagina*, and reaching from the top of the Pod to the Flower, where 'tis enlarg'd into four great Portions, which never opens till the *Apices* shed their Dust downwards, the *Stamina* being about ten or twelve, arise from the inner Surface of the *Petalon* (which is deeply divided into four Segments)

round the Edge of a *Pelvis*, or rather the top of a *Funnel*, into which the *Farina* falls, where being mix'd with a viſcid Liquor, it gradually deſcends, and reſts upon the top and out ſide of the *Fructus Rudimentum*, where it emits its prolifick *Effluvia*.

Convolvulus Major Albus, is a large, uniform, monopetalous, white Flower (*aa*) *Fig.* 3. with five *Stamina* ariſing from its bottom, and bended outwards, in order to form a Cavity, in which the *Farina* is lodg'd (*bb*) endow'd with ſo many *Apices* (*chhhhh*) and a *bifid Stylus* in the middle (*d. l.*) ariſing from the top, coherent to, but not continuous with the *Fructus Rudimentum*. In the Interſtices, betwixt the Origines of the *Stamina*, are to be obſerv'd five Holes in the bottom (*ggggg*) which could not be repreſented without cutting off the Borders (*f*) and removing of the *Stamina* and *Stylus*. Theſe Holes are what never any Perſon obſerv'd before; for what I can learn, the *Farina* is lodg'd upon that ſide of the *Apices* which is towards the *Petalon*, and oppoſite to the *Stylus*; ſo that when the *Farina* is ſhed, none of it can touch the *Stylus*, but it falls into the *Holes* ſo plac'd, as to receive it; ſo that what by the Cavity form'd by the *Stamina* round the *Stylus*; and what by theſe Holes, all the *Farina* is retain'd without any Viſcoſity, till it has emitted its *prolifick Effluvia* to the tricapſular Fruit juſt below it.

The next Contrivance is a Viſcoſity, where the *Calix* becomes the Fruit, where there are Male and Female-Flowers, upon diſtinct Pedicles, and where there are certain Protuberances upon the top of the *Fructus Rudimentum*, as in *Tab.* 11. *No.* 1, 2, 3, 4, 5. See the Explication of the Figures of the Flowers of Cucumbers, Melons, Pomkins, Gourds, and Calabaſhes. All theſe are ſo obvious, that I need no more than to have Recourſe to the Table for a Demonſtration.

I come in the third Place to take Notice of a ſpecial Contrivance in the *Orange-Flower*, of which I have had the good Fortune to be the firſt Diſcoverer. It has been generally believed, that none of the *Eſculent Fruit-Trees* had *Male* and *Female-Flowers* upon diſtinct *Pedicles*, until I firſt obſerv'd them upon *Orange-Trees* in Mr. *Fairchild*'s Garden, where they are to be ſeen plentifully in the Months of *May*, *June*, and *July*, and ſometimes in *April* and *Auguſt*. Theſe *Flowers* are *Polypetali Roſacei* in *Tournefort*'s Phraſe, (*bbbb*) *Fig.* 4. *Tab.* 1111. whoſe Attire in Dr. *Grew*'s Language, conſiſts of ſeveral *Stamina*, ſo combin'd as to make up one Body, *Vagina*, or Sheath (*h. i.*) loaded with *Apices* ſurrounding a ſolid *Stylus* (*e*) with its Button (*a.a.a*) and ſituated upon the *Fructus Rudimentum*, plac'd in the *Calix* (*f*). The *Male-Flowers* upon a ſeparate Pedicle, have their attire conſiſting of a great many dis-join'd

Stamina, with their *Apices* (*m. n.*) without any *Stylus* or *Fructus Rudimentum*, but an empty *Calix* (*o*). This *Vagina* (*h.i.*) is so situated round the *Stylus* (*k*), and plac'd in the *Calix* (*l*), that whatever *Farina* either falls from its proper *Apices*, or the *Apices* of the *Male-Flower* (*m*) must drop down, and be retain'd upon the *Fructus Rudimentum*. The *Male-Flowers* are more numerous than the Female, and their Pedicles smaller, weaker, and more brittle; so that upon the least Touch they fall off, and casually falling upon the *Female*, they empty their Dust as well by that Means, as by being stop'd there when driven by the Wind; and this *Vagina* as readily receives and contains it, as a Cup or Vessel receives Rain from the Firmament. I have frequently try'd the Brittleness of the *Male*, and *Toughness* of the *Female-Pedicle*. The *Stylus* is so solid, that no *Farina* can pass that way; and though it did, the *Fructus Rudimentum* is close at the top, where the *Stylus* is join'd to it; and every one knows the Toughness of the *Orange-Pill*, so that there is no means of Entrance or Passage for the *Farina* through it, and yet the *Seeds* seldom fail to be *fecundated*, as appears by the *Oranges*, *Limons*, and all other *Fruits* of that kind rais'd from the Seed by Mr *Fairchild*, in his own *Garden*, of which he has a good Variety, and which he brings to produce *Flowers* and bear Fruit, before they are much above two Foot

Foot high, as large as ſome that are brought from abroad.

Mr. *Fairchild* informs me, that he obſerv'd above twenty Years ago, thoſe he termed *barren* (Male) and *fertile* (Female) Flowers, upon the *Malus Perſica*, or Peach-Tree, which he could eaſily diſtinguiſh before the *Flowers* were blown. Theſe two Examples of the Parenchymatous *Fruit*, ſuch as the *Oranges* and *Limons*; to which may be join'd the *Apples*, *Pears*, *Quinces*, &c. and Stone-Fruit, ſuch as the *Peaches* and *Apricocks*; to which may be alſo join'd the *Plumbs*, and *Cherries* may give an in-let to the making both of uſeful and practical Obſervations: Uſeful ſo far as to let People know before-hand whether there will be much Fruit in ſuch and ſuch a Seaſon, by conſidering the Proportion the Female bear to the Male Flowers, which it will be eaſy to diſcern, by the *Calix* or bottom of the *Flower* being fill'd or empty, even before it is blown; and practical, becauſe when one finds the Male-Flowers exceed the Female in Proportion; and that for ſeveral Years they may fall upon Means to render the Tree more fertile, by dunging, pruning, *&c.* And here the Obſervation Mr. *Ray* had from the Farmers concerning the *Hemp* or *Cannabis*, holds good, " That when " 'tis ſown more thin, in fat Ground, the " *Female* (which he miſtaking the Sex calls " the *Male*) Plants abound; and when ſown

" in poor Ground, or very thick in fat Ground, " then the *Male* (called by him the *Female*) " Plants abound[a]". We need be at no Pains to explain this, when we consider, that the more subtile Particles ascend first, and make up the *Farina*, and that the grosser Particles, which go to make up the *Embryones*, are later in their Ascent. Nor are they so frequent in superficial as in deep Ground. So that if any observe too great a Quantity of Male-Flowers upon the Fruit-Trees, they are then warn'd to fall upon Means to prevent the Barrenness.

The fourth Contrivance is, that of the *Villi* or *Hairs*. This is more-especially to be observ'd in the *Rose*, where there is a conspicuous Tuft of Hairs in the Center of the Flowers, surrounded by a great Number of *Apices*, called *Anthera* by the Apothecaries. The *double Roses* seldom fructify, but if you shall take the *Hip* of one that's *semi-double*, as the *Gardiners* call them, and open it when it begins to swell, and the *Seeds* begin to form, then you may observe several of these *Villi* tending to each of the *Acini* or *Seeds*; but they do not convey the *Farina* to the *Seeds*, as Mr. *Morland* would have them, for they are spread forth and surround it, and the *Seed* is as much shut at the upper as the lower end; so that the *Farina* cannot enter it; and this Con-

[a] Catal. Plant. circa Cantabrig. p. 26. Edit. Anno 1660.

trivance

trivance seems only to be, to transmit the *Effluvia* from the *Farina* in greater Abundance to each *Seed*; for the Membrane of the outer Coat being thick and hard, needs a greater Supply of spirituous Particles to set its inner Substance in Agitation. And as to the Hairs of the *Strawberries*, it will be found that most of these arise from the *Placenta*, pass through betwixt the Interstices of the *Globuli*, and so keep the Berry from falling off too soon; for its but very slenderly fix'd to the *Placenta*, and would soon fall off when the *Globuli* are fill'd, before the Fruit were ripe, if it were not for a glutinous Humour, and these Hairs which keep it firm in its Place. The like is also to be observ'd in the *Rubus*, so that this Example will serve no more for Mr. *Morland*'s Purpose than any of the rest.

I come *next* to propose some more Arguments against the *Farina* entring the *Stylus*; and, 1. Did the *Farina* enter the Seed-Vessel, and were each Grain introduc'd into its proper Receptacle, then it would follow that these nearest the top being first fill'd, would first augment and ripen, *v. g.* In a *Tulip* there are six Rows of Seeds, in three *Loculamenta* or Pouches, regularly plac'd, the Grains of the *Farina* entring the top of the *Pistillum*, and gradually descending, would fill the proper Receptacles or Husks of Seeds as they went along; so that those at the top would be firm and hard, when those below would be but

empty; whereas the contrary is plain. For as the *Leaves* and *Flowers* of Plants, neareſt to the *Root*, are firſt ſpread forth, and firſt blown, ſo the *Seeds* in the *Pod* or *Seed-Veſſel*, neareſt the *Pedicle*, are either firſt fill'd and ripe, or the nutritious Particles being equally diſtributed to all, the Seeds fill and ripen equally, which they would not do were there a gradual Deſcent of the *Farina*, and without that each Seminal Plant of the *Farina* could not find out its predeſtined *Caſe* or Neſt wherein to lodge.

In the *Papylonaceous* Plants, ſuch as *Peas* and *Beans*, the entring by the *Stylus* (which by the by is not cavous, but hard, ſolid, and cartilaginous) into the *Pod*, will not do; for there muſt be a long Tube or Duct running down the back of the *Pod*, with a Door or opening to each of the Seed Caſes, by the ſeveral *Placenta*'s which wants to be found out, and a hollow Tube to each of the *Seeds* in the *Fruits*, where the *Seeds* are adherent to ſeparate *Placenta's*, as moſt of them in the ſiliquous Plants are. Theſe Conſiderations want new Diſcoveries.

2. The Quantity of the *Farina* muſt be proportion'd to the Quantity of the *Seeds*; ſo that where there are many *Seeds*, the *Farina* muſt be in large Quantity; and where there are but few *Seeds*, a ſmall Quantity will ſerve; for there muſt always be an Allowance of ſome to be loſt. *Jallapa*, or *Mirabilis Peruviana*,

Peruviana, Fig. 5. cap. Tab. 111. has a *Monopetalous Flower* (*A*) *five Stamina* (*B*), a *Stylus* with its *Button* (*i*) has only one Seed enclos'd (*F. G.*) within one *Capsula* (*H*) The *Farina* is so carefully preserv'd from the Danger of losing, that it can be safely convey'd down to the *Capsula* (*F*) by a long Tube (*D*). *Nicotania* has a *Monopetalous* Flower, *Fig.* 13. *Tab.* 1. divided into five *Segments* (*aaa*) with the *Stylus* in the middle; and its proper *Button* (*b*) surrounded by five *Stamina* and their *Apices* (*c.c.*). The *Pistillum* becomes a large conical *Fruit* (*a*) opening longitudinally (*b*), and contain'd within a *Monophyllous Perianthium* (*c*), containing a vast Quantity of small, minute *Seeds*.

Caprifolium of Mr. *Morland* has five *Stamina* and *Apices* to one *Berry*, containing one *Seed*. *Papaver* has a great many *Apices*, and the Seeds do not amount to above half the Number of *Nicotiana*, *Avellana*, *Nux Juglans*, have but one *Kernel* to each *Nut*. *Abies*, *Pinus* have twenty or thirty to each *Cone*; and the Number of the *Juli* in the *Avellana*, exceed that of the *Amenta* in the *Abies*. *Lappathum*, *Acetosa*, *Atriplex*, *Parietaria*, have several *Stamina*, *Apices*, and much *Farina*, and yet there is but one naked *Seed* to a *Flower*, to which the *Farina* has much more easy access than to a *Capsula*.

All these Examples, duly consider'd, cannot but infer another manner of Impregnation than

than each Grain of *Farina* to a *Semen*: For as *Nature* is *uniform*, ſo it is always *conſiſtent* with it ſelf, and therefore 'tis not to be ſuppos'd there would be as great an *Apparatus* of *Farina* to *Jallapa*, as to *Nicotiana*, and as great Care had in preſerving the one as the other. If but one Grain can only be employ'd in *fecundating* the Seed of the *Jallapa*, and there is above one hundred to be impregnated by the ſame Quantity of the *Farina* in the *Nicotiana*, is not that inconſiſtent, that there ſhall be a quadruple Quantity of *Farina* to half the Quantity of Seeds in the *Poppy*; that every Berry with one Seed ſhall have a proper *Flower* in the *Caprifolium*, and that a greater Number of *Katkins* ſhall be requir'd to one *Kernel* in *Nux Juglans*, than to twenty or thirty in *Abies*, *Pinus*. I hope all theſe Inſtances will ſet People upon another way of thinking concerning the Impregnation of Seeds in Plants; for as I am as much convinc'd as any, that no Seed can be fertile without ſomewhat to actuate and enliven it, from thoſe call'd the Male Parts of the Flower, where there is a particular Preparation us'd for certain Particles fit for that purpoſe; ſo I cannot detain my ſelf after ſo many probable and convincing Arguments, ſo many pregnant, and I may ſay undeniable Proofs, and ſo many demonſtrable, real Facts, from pronouncing that this Impregnation can be no otherways perform'd

than

than by ſome *Emanation*, ſome *vivifick Effluvia*, ſome *prolifick Virtue* communicated by means of this *Farina*, or ſome other *Menſtruum*, from the *Male* to the *Female* Parts of the *Plant*, by virtue of which the Parts of the *Seed* are diſpos'd to be dilated, the *Tubuli Nutritivi* enlarg'd, a greater Supply of *Nouriſhment* to be furniſh'd, and all the Particles compoſing the Seed ſo to be ſet in Motion and regulated, that they can be augmented, extended, and encreas'd to a due Proportion, which one Grain of ſmall Duſt, ſo confin'd, could never do.

I have added *ſome other* Menſtruum *than the* Farina, becauſe of the *Water-Plants*; where, though generally ſpeaking moſt of them ſet their Head above the Water before they begin to flower; yet ſince they can never be kept dry, and conſequently the *Farina* muſt be always form'd into a Paſte; therefore the *Menſtruum* here, muſt be that viſcid Liquour ſo often mention'd, which tranſudating the Pores of the *Apices* and *Stamina*; and being of ſo tough and balſamick a Conſiſtence, it cannot eaſily mix with the Water, but floating along, may be convey'd from a *Male* to a *Female-Flower* of the ſame *Plant*, there to *fecundate* the *Seed* in the *Seed-Veſſel*, as much as the *Farina* do's when driven with the Wind. And let any one judge whether the *Seminal Plant* can be contain'd in this Liquor, any more than in the dry *Farina*. I acknowledge

I was very much straitned how to do with the Flowers in Water-Plants, in relation to the *Farina* and this *Fecundation*; but having only receiv'd a small Hint from *Dillenius*, in his Description of *Hippuris*, or Horse-Tail, which fructifies though 'tis never to be seen above Water. I am the first who have made this Improvement of it, being persuaded this is as effectual in the Water, as the other is in the Air.

And why should that of Impregnation by the *Effluvia* seem improbable, when we have so frequent Experience of the Divisibility of Matter, and of the wonderful Effects of a few active, volatile, spirituous *Particles*. *A little Leaven leaveneth the whole Lump*, if I may use a Scripture Phrase when contemplating the wonderful Works of *Almighty God*. A small Quantity of an acid, will sowre a great Quantity of Dough; one Grain of Musk among Cotton, will scent several Pounds of Powder of Starch, if successively put in amongst them; and that Powder will scent a great deal more, if mix'd with it while the Musk shall lose nothing of its Weight. The smell of a few Violets will continue in a Handkerchief a good time. The *Effluvia* of some Creatures, such as Cats, *&c.* will be noxious to some, and throw them *in Deliquium Animi*, while others present shall not be sensible of it. One Grain of *Laudanum* will affect perhaps twenty five Pound of the Blood of a Man's Body;

Body; it will calm and quiet his Spirits, and diſpoſe him to reſt amidſt the moſt raging and violent Fevers; when all the volatile Particles of the Humours of his Body, are as it were in a Vapour and Smoak, it will compeſce and fix them, as Water will quench and extinguiſh the Fire when thrown upon it. One Drop or *Gutta* of Oil of *Cinnamon*, *Mint*, or *Aniſe*, will impregnate a great Quantity of Sugar, and affect the whole Air in a large Room, and the more it is divided, the more lively it affords the Smell.

Theſe, and a great many other parallel Caſes, may be ſo convincing, that we need only to have recourſe to the *Effluvia* for the Explanation of ſo great a Myſtery as that of the Generation; for then we can conceive how the moſt ſubtile and vaſtly divided Matter, to which no Pore nor Part of a Plant can deny the *Tranſitus*, may produce ſuch ſtupendious Effects; but if we will ſuppoſe the *Seminal Plant* to be in each *Granula*, each ſmall Particle of the *Farina*, how difficult will it be to find out ſo much as a probable Paſſage for it? For we muſt ſuppoſe this Grain of the *Farina*, however minute, to be an organiz'd Body, conſiſting of a *Congeries* of ſuch and ſuch Particles, and ſo diſpos'd and compos'd, after ſuch and ſuch a manner of ſo many other little Particles, that every ſmall Pore will not do the Work. For it muſt be ſo and ſo directed, and there muſt not the leaſt

Impediment

Impediment be in the way; but it muſt be as it were hood-wink'd, and led by the Hand into the very Place prepar'd for it; and if it meet with the leaſt Obſtacle, it's in hazard of being ſhiver'd to Pieces; and its fine and delicate Texture is in danger of being diſſolv'd, ſo that it may come to periſh before it ſhould receive its Life. And pray what a happy ſtate and Condition ſhould we be in, when our want, or having of Bread, muſt depend upon the accidental getting of one Grain of the *Farina* into each particular *Embryo Seminis* of the Wheat? Might not an accidental Blaſt of Wind ſhake off all the *Farina* from every *Apex* in each Spike or Head of the Wheat, and would it not by that means remain empty, ſo that we ſhould have no Bread to eat? Nor would the unimpregnated Seed produce and let us have a new Crop againſt next Year. Whereas, when we ſuppoſe an Emanation to flow from the *Farina* in the *Apex*, ſo ſoon as it is ripe, the Wind is ſo far from hindering its Operation then, that it furthers it, and we need be at no Difficulty to conceive how the Seed may be fill'd, ripen, and rendred fertile.

Having aſſerted, page 225. *That the Propagation or the Production of the Species, was the effect of the vegetative Life in Animals as well as in Plants.* I come now to make good the Analogy. Theſe now called *Ovaria*, were by the ancients called *Teſtes Fœmineæ*,

Fœmineæ, and they then ſuppos'd that the Impregnation proceeded from a Mixture of the *Semen Maſculinum* with the *Fœmininum* in *Utero*. But it being afterwards diſcover'd, that theſe they call'd *Teſtes*, is a *Congeries* of certain little *Globuli*, compactly united, conſiſting of a viſcid, limpid Subſtance, within a proper Membrane, and all involv'd within a common Tunicle, call'd *Ova* or Eggs, one of which, after a fertile *Coitus* is detach'd, receiv'd into a certain Paſſage, called *Tubæ Fallopianæ*, from *Fallopius*, the Diſcoverer, convey'd into the *Uterus*, there to increaſe and become a *Fœtus*.

The manner of this Impregnation is as much diſputed as that of the Seeds of Plants; ſome aſſerting the *Materies Seminalis Maſculina* paſſes directly to the *Uterus*, and from thence to the *Ovarium*, either in Subſtance, or by certain *vivifick Particles*, to to which the groſs Subſtance is only a *Menſtruum*. Others deny their Entry to the *Uterus*, but will have them to be receiv'd directly into the Blood-Veſſels, round the *Vagina*, and that paſſing along with the Blood in the Circulation, they impregnate one or another of the *Ova* when they arrive at the *Ovarium*. All this time there was no thought of the *Animalcula* to contain all the Lineaments of an *Embryo*, and that one of them MUST be convey'd to the *Ovarium*, and enter a particular *Ovum* there, to be nouriſh'd, encreaſe, and be augmented,

mented, ſo as to become a *Fœtus*, until the Perſpicacious Mr. *Lewenhock*, by his Microſcopical Obſervations, diſcover'd them to be in *Semine Maſculino*.

I ſhall not doubt of the Exiſtence of theſe *Animalcula*, for that would be to call in Queſtion, not only Mr. *Lewenhock*'s own Credit and Veracity, but alſo the Teſtimony of ſeveral Valuable, Ingenious, Noted and Learned Perſons, of great Integrity, Fame, and Reputation, who affirm they have obſerv'd the like. But whether theſe *Corpuſcules* be actually the *Embryones*, containing all the Lineaments, which are afterwards to encreaſe, be augmented, and form'd into a *Fœtus in Utero*: Or whether they be only certain little *Animalcules* living and moving in their proper Element, as Terreſtrial Animals do upon the Earth, or Fiſhes in the Water, is the Queſtion.

Dr. *Liſter* has ſav'd me the Trouble of ſtating a Queſtion ſuitable to this Purpoſe, which I had a mind to do long ago; and before I knew he had meddled in the Debate, *viz. An hæc Animalculorum proles fere diurna ſui ſimilibus Animalibus generentur? An ſponte naſcantur* [a]?

Mr. *Lewenhock*'s Anſwer to theſe Queſtions, is as follows. "Now, ſays he, if we know "which way the Fiſhes do encreaſe, that it

[a] Philoſoph. Tranſact. No. 244. p. 337. Liſter exercit. Anat. tert. p. 114.

" is not done by intermixing of the Male " and Female Seeds; and likewiſe we do know " the great Myſtery that is included in the " ſmall Seed of an Apple; why might we " not then aſſert, that *a whole intire Man* " *is contain'd in an Animalcule of the Maſ-* " *culine Seed, and that the Animalcules of* " *the Male-Seeds are all deſcended from* " *the firſt created Man*?

I cannot but think Mr. *Lewenhock* has been much put to it for Anſwer to thoſe pinching *Queſtions*, when he was oblig'd to uſe ſuch Subterfuges, which are mere Hypotheſes, and no ways demonſtrative.

The Opportunity I have had of enquiring more particularly into the manner of Generation of the *Salmon*, which I lately communicated to the *Royal Society*, has convinc'd me, that the Generation of Fiſhes will not favour Mr. *Lewenhock*'s Opinion. For *eo Momento*, that the Female Fiſh ejaculates the Roe, the Male is ready to throw the Milt upon it. The Roe is a *Congeries* of a vaſt many little, firm *Globules*, compactly united.

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[a] Tranſact. No. 255. p. 270. Cognitâ piſcium generatione, quod nempe illa non peragatur niſi ex ſeminali marium fœmellarumque commixtione; cognito quoque magno illoar cano, quod in unoquoque mali ſemine latet eique incluſum eſt; quid obſtat quo minus ſtatuere liceat in animalculo ex ſemine virili integrum latere hominem, atque animalcula ex ſeminibus virilibus ab primo quoque homine originem ſuam trahere. Epiſt. 117. p. 99. Ad Societatem Regiam Jun. 27. 1699.

The Milt is a ſofter, flexile, and as it were Milky Subſtance. The Difference of the Conſiſtence do's not admit of an entire Union or intimate Commixtion of both; but the one being thrown out firſt, is the lower, the other lies above it. The ſtrict Union and Compactneſs of theſe *Ovula*, plainly denies free acceſs to the *Animalcula in Semine Maſculino* into every one of them; but the *Effluvia* from the *Milt* is capable enough to ſet the Seminary Particles in the *Ova* in Agitation, to be rang'd, form'd, and put in ſuch Order as to compoſe a ſmall *Smelt*, while the groſſer Subſtance, as it is a *Menſtruum* to the more ſubtile, ſo it ſerves as a *Fomes* to the *Ovula*, as the heat of the *Hen* ſerves to hatch a Chicken; ſo that Fiſhes in that reſpect are Oviparous Animals in the Water, as Birds are on the Earth.

For the Myſtery of the Seed of the Apple, by its being the Succeſſor of a regular Flower, it makes no more for Mr. *Lewenhock*'s Purpoſe than any other part of the Creation; but if we only look upon them as being impregnated in common with other Plants; and if we conſider the Multiplication of the ſeveral Species, we may look upon *Nicotiana* to be more appoſite to his Purpoſe, according to *Sennertus*'s Calculation.

But I do not ſee of what Force theſe two Inſtances can be to prove, *That in an Animalcule of the Maſculine Seed is lock'd up a*

whole Man, and that the Animalcules of the Seed are descended from the first created Man. Almighty God might, if he had pleas'd, have continu'd the first created Man till this present Time, and might have ordered it so that his Body should consist of the very numerical Particles it did when he was first created. In that case these *Animalcula* might have continued from the first created Man. But since in his Wisdom he has not thought fit so to do, but has ordered it so that the first Race should die, in order to make room for succeeding Generations; and since he has so dispos'd of the Bodies of Animals, that they do not always consist of the same numerical Particles; but that *Hominem vivere est continuò mori*; that our very Life consists of a continual *Dispendium* of the more subtile and volatile Particles, instead of which we are daily furnishing our selves with a new Supply of nutritious ones, which when sufficiently attenuated go off in their Turn, so that our Body is made up of a daily Course of succeeding Particles, as the World is peopled by a continual Course of succeeding Generations; and how this Identity of *Animalcula* should continue without a *proles fere diurna à sui similibus Animalculis*, I do not understand.

It's a very suitable Question of Dr. *Lister*'s *An sponte nascantur*; and Mr. *Lewenhock*'s Answer is well enough to the purpose. "Now, "says he, that these Animals should come or

"proceed from themſelves, ſeems to me not "to be apprehended; for if they ſhould come "from or out of themſelves, I imagine that "they could not be all endow'd with the ſame "Quality as now they are[a]. *Philoſoph. Tranſact. Ibid.*

Then the Queſtion returns, are they all of the ſame Quality? then they muſt be organiz'd Bodies, conſiſting of the ſame Lineaments, having the ſame Figure, Shape, and Features. And how can they be thus generated, unleſs there be Males and Females among them, as among all other Animals? 2. If they have proper Males and Females, then they muſt be a diſtinct Species from that of a Man; and if ſo, how can a whole Man be lock'd up in the Seed of a Man? Since then it muſt be granted that theſe *Animalcula* are the Product of Male and Female of their own Species (otherwiſe the whole Courſe of Nature is perverted in one of its moſt eſſential Regulations, *viz.* that of Generation, which is not to be ſuppos'd) and are quite diſtinct Creatures from that of a Man. It is impoſſible they can be the firſt Lineaments of a human *Fœtus*; for then there would be a Traſmigration of Bodies, from an Inſect to a Man,

[a] Quod verò an Animalcula ſponte oriuntur, id ego, ut verum fatear, concipere nequeo. Si enim illa animalcula ſponte ſuo prodirent, tunc non omnia animalcula maſculina iiſdem qualitatibus prædita fore mihi perſuadeo, quod tamen nunc obtinet. Ibid. p. 198.

which is utterly absurd, and altogether inconsistent with the Divine Majesty of God, and with that Dignity he has conferr'd and bestow'd upon Man, by making the very Spawn and Dregs of the vilest of all Creatures (for Insects are so according to the Nature and Station they bear in the World, however fine and curious their Texture may be) become the Parents of the Lord over all created sublunary Beings; and how much must they be so, when they are ordain'd for Slaughter so soon as they have Life? What Murder and Havock must there be made of them, when one of many Thousands has only the good Fortune to be preserv'd? But another Question is, whether they are dead or alive at the *Coitus?* If they are not alive, then they cannot be called *Animalcula*; but Mr. *Lewenhock* seems to be positive they are alive; if so, they must lay down one Life which they enjoy'd, previous to the *Coitus*, and take up another after the *Coitus*; for there is nothing more plain and obvious than at, or immediately after the Impregnation, the *Fœtus* partakes equally or proportionally of the Female as well as of the Male. The Features, the Gestures, the Humours, the Tracts of Face, the Temper, the Stature, the Voice, the external Shape and Figure of the Body; the inward Passions of the Mind, the Distempers, and frequently the virtuous and vicious Inclinations, are as much imparted to us by our Mothers as by

our Fathers; and this is obvious to us every Day, in thoſe they call Mongrel Animals; when a Ston'd Horſe and a She-Aſs produce a Mule, which though it exceed the Mother in Bigneſs, yet it partakes very much of her in Shape, and particularly the Voice, which is called the Braying. And when of a Bull and a She-Aſs is procreated a certain Animal, called *Joumar* *, as I am credibly inform'd *by the Intelligent Dr.* Sherard, who has often ſeen them in *Turkey*, where they are very frequent, and of great Uſe, as being excellent Beaſts of Burthen, and of a quick Pace upon a March, a property not very incident either to Father or Mother. This *Animal* is a compound Mixture of both, and by being ſo, of a very unuſual Shape. Though theſe Animals, as it is generally believ'd, are condemned to a perpetual Barrenneſs, to prevent the confounding of the Species; yet they with the former Inſtances, are ſufficient to demonſtrate, that there is more requir'd of the Female at the Impregnation, than to furniſh a mere Caſe, *Nidus* or Neſt in the *Ovum* and *Uterus*, for the *Embryo* to lodge in, and only to afford Nouriſhment to it as well before the Birth, as ſhe do's Milk after it: So that I have very good Reaſon to join with a certain Correſpondent to Sir *C. H.* in the *Tranſacti-*

* *See its Figure in* St. Leger's Hiſtoire de l'Egliſe Vaudois, fol.

ons,

ons, when ſpeaking of his Obſervations on the Animals in Waters. —— "And I am confi-"dent, ſays he, many of theſe are the ſame "Creatures, under different Dreſſes; for I "have noted ſuch a regular Proceſs in them, "and ſuch a conſtant Order of their Appear-"ances, that I am of the Opinion moſt of "them are the Product of the ſame inviſible, "volatile Parents, and generated like Gnats, "and many other Sects of Flies[a].

This leads me into a Query which ſhould have been propos'd by Mr. *Lewenhock*'s Followers; for *Affirmanti occumbat probatio*, (for by what I find, he do's not account for it himſelf) *viz.* How came the *Animalcula* into the *Veſiculæ Seminales*? And, 2. Why are they rather to be ſeen in the *Sperma*, than in the Blood, Bile, or Urine? For the firſt, I ſuppoſe, and its pretty plain and obvious, that our Meat, Drink, and the Air we breathe in, are full of the *Ova* of *Animalcula*; for they are continually depoſited upon the Flower, the Bread, the Fleſh, the Water. When we are adult, our Stomach is capable to attenuate and digeſt, not only the Aliments we ingeſt or take in, but alſo moſt of theſe *Ova* muſt undergo the common Fate of a Comminution and Attrition of their Particles. But when we are under Age, and our Stomach is weak, then it is that the *Ova* eſcape,

[a] Philoſoph. Tranſact. No. 214. p. 1366.

and the Maggots are generated in our Body; ſome of the coarſer, becauſe they cannot enter the Pores of the Lacteal Veſſels, are generated in the Inteſtines. Hence it is that very few Children are free of Worms; it's to be preſum'd and pretty plain, that theſe Maggots may depoſit their *Ova* in the Inteſtines, ſome of which may be ſo ſmall as to get Admittance into the Lacteal Veſſels, whence mixing with, and circulating along with the Blood, they can be the more readily ſeparated from its Maſs by the *Vaſa Spermatica*, than any other Subſtance, becauſe, when *Ova*, their Surface, is polite and ſmooth; and conſequently, if they be ſo minute as to enter the *Tubuli*, they can eaſily be convey'd along the vaſt Quantity of *Gyres*, *Meanders*, Turnings and Windings in the *Teſtes* and *Epididymides*, 'till they arrive at the *Vaſa deferentia*, and thence paſs into the *Veſiculæ Seminales*, whither there arrives daily Addition, until the *Pubertas*, that is, the Evacuation, begins; for as we ſee before the Birth of the *Fœtus*, the Inteſtines are full of the *Meconium*, and the Bladder is full of Urine, ſo we may ſuppoſe a continual Addition of new Particles to ſtretch forth and extend the Cavities of the Seminary Veſſels, 'till the Boy is of Age; and this Subſtance may as readily conſiſt of theſe *Ova* as not, when once they are there; and in a *quies*, 'tis eaſy to believe they may become *minute Animalcula*, and ſo obduce the Surface

of

of the *Vesiculæ*, that they will never be free of the Spawn, so long as the Age of Fertility continues; and this seems to be demonstrable enough, from the *Worms* in the *Vesiculæ Seminales*, which Mr. *Lewenhock* observ'd in a young Ram before he had begun to copulate. And for the *Proles fere diurna*, the Generation of Insects is every where so sudden, that if you observe a *Chrysalis* (in which a Worm had been wrap'd up) full the one Day, next Day you shall see it empty, and the Butter Flies got out of it flying abroad in their full Stature and Bigness, who when they have liv'd some time copulate, deposit their *Ova*, and shortly after die. These *Ova* are so numerous, that it's computed one Female-Silk-Worm shall emit three hundred *Ova* or Grains, more or less, after one *Coitus*; so that there's no Difficulty to conceive how, (if once these *Animalcula*, though but a very few, get into the *Vesiculæ Seminales*) they may leave a numerous Spawn behind them when thrown out, and how they can be so suddenly generated. As to the second Question, Why they are only observ'd in the *Sperma Masculinum*, and not on the other Fluids of the Body, such as the Blood, and the several other Secretions from it, as the Bile, Urine, *Saliva*, *&c.* The Blood being a Composition of all the various Particles of the other Fluids, appears under a more solid form in *Globules*, where the several Particles are compactly and firmly united,

ted together, so that if there be any *Animalcula* or *Ova*, they are not so easily to be discern'd, unless the Particles were dis-united, and then it would cease to be Blood; and for the *Serum*, in which the *Globules* swim, as we must suppose the *Ova* or *Animalcula* to have somewhat of a solid Consistence, they can never make up a part of that Fluid: Neither can the Bile or Urine, separated from the Blood, contain any of them, because the Texture of their Particles is such, that neither the Glands which separate, nor excretory Ducts which convey them, will admit of any other; so they seem only to be adapted for the *Ductus Spermatici*, where, when *Ova*, they can easily descend, and when *Animalcula*, by the Flexibility of their Body, they can easily undergo the various Turnings and Convolutions of the *Tubuli* in the *Testes*.

Thus I have accounted how the *Animalcula* may come to be only in the *Vesiculæ Seminales*, supposing them to exist; but this do's not contradict the Doctrine of the *Effluvia*; for these *Animalcula*, being *Organiz'd Bodies*, as I have observ'd when speaking of the *Farina* in Plants, must make up the grosser Part of the *Compositum*, so that the more subtile may lodge in the Interstices, betwixt these *Corpuscles*, and by being more active and volatile, may be first set in Motion, so that during the *Coitus*, they may reach the *Ovarium* or *Ovum* it self, while

the

the other can penetrate no farther than the *Vagina* or *Corona Uteri*, ſo that the one becomes only a *Menſtruum*, a guard to the other to conduct it in its way; and the one can fly to actuate and enliven the *Ovum*, while the other is fain to ſtay behind.

But farther, let us conſider the Certainty and Determination of the Number of the *Ova*, to be impregnated at a fertile *Coitus*; how humane Females, and the Females of other Animals, ſuch as Cows, Mares, and moſt of the larger Quadrupeds, have only one *Ovum* impregnated at a Time, and if there be any more, that's preternatural, becauſe exceeding the Determination for ſuch an Animal to be propagated ſo and ſo at the Creation; how there is no Superfetation, but that after one *Ovum* is impregnated there can be no more (unleſs preternaturally) during the Time the Product of ſuch an *Ovum* is *in Utero*; how again, leſſer Quadrupeds, ſuch as Bitches, Cats, *&c.* can have ſeveral *Ova* impregnated at one *Coitus*, without a Superfetation, and how others have naturally a Superfetation, ſuch as Hares, Rabbits, *&c.* and after every *Coitus* they produce a new Litter of *Fœtus*'s, even while the former ſhall remain in *Utero*. Can all this proceed from an accidental getting of the *Animalcula* into one or more of the *Ova*? Muſt it not depend upon a previous Diſpoſition of the *Ovum*? Can a minute *Animalculum* contribute any thing towards

towards this Diſpoſition? Muſt not the Particles of the *Ovum* have been ſo and ſo regulated and diſpos'd, before ſuch an Impregnation? And do's not the very determinate Number of the *Ova* impregnated at ſuch and ſuch a Time, demonſtrably prove that? Why, then, ſhall we ſuppoſe, that ſo ſoon as an *Animalculum* gets into the *Ovum*, all theſe wonderful Effects, as the Conſequence of the ſimple Act of the *Coitus*, ſhall be perform'd? If *in an Animalcule of the Maſculine Seed of a Man, a whole Man is lock'd up*, then the ſeveral Particles previouſly in the *Ovum*, are no more than the firſt Food to this Stranger; this new arriv'd Child (who after being fatigu'd by ſo long a Journey, and through ſo many difficult and unacceſſable Roads, when all thoſe in Company with him have been ſo wearied, that they are left behind and kill'd) has need of ſuch Refreſhment to rouſe up his Spirits, and to make him grow up ſo as to become a brisk and lively Boy. But if in the Female *Ovum* there be ſuch a *Congeries* of Particles of different Textures heap'd up together, as to furniſh the firſt Materials for all thoſe various Subſtances of which the animal Body is to be compos'd; is it not more reaſonable to ſuppoſe, that this Subſtance only wants ſomewhat to actuate and enliven it, and to ſet all theſe Particles in ſuch a Motion, that they may be regulated, rang'd, and ſet together ſo as to form the Lineaments of a

Fœtus,

Fœtus, ſo ſoon as this prolifick Virtue is communicated to them; and to ſuppoſe, that not only the Particles in the *Ovum* it ſelf are ſet in Agitation, but likewiſe that the whole Maſs of the Blood aſſiſts in furniſhing a continual, freſh Supply of new Materials, in order to rear up this fine, delicate, and curious Fabrick of the Animal Body? And that until theſe different Subſtances be got together in ſuch a Proportion as to lay the Groundwork within the *Ovum*, and that the immediate *Artifex*, the Male-Animal, being influenc'd by the great Author of all Things (*for a Sparrow doth not fall to the Ground without the Will of God*) cannot operate, ſet theſe Materials in Motion, till all Things be got together? So that as it's plain that the *Ovum* cannot be impregnated before its Particles are diſpos'd in ſuch a manner, and in ſuch a Proportion; ſo its likewiſe plain, that the Seminal Matter muſt be previouſly in *Ovo Fœmineo*, and not in the *Animalcula* in the *Semen Maſculinum*.

To render this ſtill more obvious, let us enquire how an *Animalculum* an *Organiz'd Body*, formerly ſwimming at Liberty, now confin'd to narrow Bounds, and render'd unactive, ſhut up as it were in a Priſon, and only receiving what Supply of Nouriſhment is furniſh'd to it, *en Paſſant*; I ſay, how ſuch a minute Animal as this, ſo ſmall and light that ſome Hundreds amount only to the Weight of

one Grain, ſhall infer ſuch vaſt Alterations upon a whole Female Body, and actuate upon perhaps twenty five Pound Weight of Blood, when it cannot ſo much as get out of its *Caluſtrum*, unleſs it is abortive, miſcarry, and be ſent a packing: Can this ſmall *Mite* be capable to render Her who was but a little before a handſome, ruddy Fac'd Girl, now become pale and wan coloured, and Her who was wont to be pale, ſo that ſcarce any Blood was to be obſerved in her Face, now become of a ruddy and gay Countenance? She who uſually had a full Face, big Cheeks, little Mouth, briſk, lively, piercing Eyes; her Eyes now become dull and heavy, the Skin bluiſh below the lower Eye-lid. The Face formerly full and round, is now long. The round Cheeks now become thin and wrinkled, and as it were cleaving to the Jaws, the Eyes hollow, ſunk and ſtaring, and the Mouth big, wide, and gaping. She who was vigorous and active, now becomes dull and heavy; and She who was watchful in the Night, and could get up early in the Morning, being thoughtful upon the Account of her Amours, if a Maid, and taken up with the Cares of her Family and Children, if a Wife, now becomes lazy, do's not care to ſtir about nor move, but when ſhe is a Bed loves to loll upon her Pillow, and when got out of it, throws her ſelf down upon every Couch, and is inclin'd to ſleep in every Corner. She who had a good Digeſti-

on,

on, did eat her Meat with a pretty quick Appetite, now loaths at every Thing she sees, and the Victuals she formerly delighted in, that she now abhors, and longs for what formerly she hated, and is improper for her, and what perhaps is not to be got; and now she forsakes her former Delicacies, and loves to take what is so coarse, that none else will eat it besides her self; her Puse is feverish, her Stomach is sick; she is squeamish, has frequent nausea's, especially in a Morning, and often she vomits; she has frequent Inclinations to Spitting, and often subject to Faintings, *Deliquiums*, Head-aches, Feebleness, Weakness, *&c.* Before she began to breed or conceive (as it is called) her *Abdomen* was little, round and plump, now her Navel is drawn in, as it were, to her Back-Bone, and she becomes smaller round the Middle than formerly. After a short Time she begins to swell, the *Uterus* to be extended the *Placenta* and Navel-String to be form'd, and the *Chorion* and *Amnios* to surround and wrap up the *Fœtus*.

And whence all this? The little *Animalculum* is now enclos'd, all its Companions, the Fellow *Animalcula*, they are dead, extinct, and unactive, none of these can do this Work; it must be somewhat else, some extraneous Bodies, some extrinsick Particles, and at first heterogeneous to the Texture of the Blood, which has proceded from without, and previously was a Stranger to the Female Body.

And

And what elſe can it be than the ſpirituous Particles from the *Male*, which iſſuing from the groſſer Subſtance of the *Sperma Maſculinum*, not only actuates and enlivens the Particles included in the *Ovum* it ſelf, but howſoever it is introduc'd, affects the whole Maſs of Blood alſo, diſpoſes it to flow in greater abundance by the *Hypogaſtrick Veſſels*, and not only augments the Lineaments of the *Embryo*, but forms all the other adventitious Subſtances?

Now if theſe Particles are capable to do that, if they are capable to affect the whole Maſs of Blood without the *Ovum*, and to contribute towards the Production and Encreaſe of all thoſe other Subſtances generated at the ſame Time, for the Nouriſhment and Conſervation of the *Fœtus*, why not to be the Inſtruments or efficient Cauſes of ſuch Alterations in the *Ovum* it ſelf? And wherefore ſhould we have Recourſe to theſe called *Animalcula?* Will the calling them in for Aſſiſtance and Vouchers to what we aſſert, render the ſtupendious Work of the Generation of Animals more clear and intelligible? I am afraid not, and whoever ſhall duly conſider what I have here objected againſt ſuch a Sentiment, will find, that to explain it after that manner, will make it *obſcurum per obſcurius*.

As I ſhall not doubt of Mr. *Lewenhock*'s Ingenuity, in relating what he has truely obſerv'd concerning theſe *Animalcula*, yet I do

ſuſpect

ſuſpect he's a little too earneſt to have his Opinion about them confirm'd. If he would have the World believe that the uſe he aſcribes to them is real, then he ſhould have examin'd the Subſtance in the *Ova Fœminea* in all *Animals*, at leaſt of the ſame Species, as he has examin'd the *Maſculine Seed*, and endeavoured to diſcover whether there was *Animalcula* in them alſo; but he is entirely ſilent as to that, for which I ſuſpect he has either try'd it, and found there was *Animalcula* there, but had no mind to communicate it, for fear of deſtroying his Scheme, or being ſo intent upon the finding of them out in the *Male-Sperm*, he has neglected the other. I'm ſorry the firſt ſhould ſo much reflect upon his Credit; and I cannot imagine how ſo curious and diligent an Enquirer after the Structure of the moſt minute Subſtances, ſhould have been guilty of the ſecond. For if by his Enquiries he had been enabled to affirm there is no ſuch thing as the *Animalcula* in the *Ovum Fœmineum*, then he could have advanced what was truly convincing; but ſince there is not one Word of that, and ſince there have been *Animalcula* obſerv'd in ſeveral other Liquors, as well as in the *Sperma Maſculinum*, I muſt take the Freedom to diſſent from him, until more pregnant Proofs be given, eſpecially when I conſider that the Subſtance of the *Ovum Fœmineum* is the *Depoſitum*, from a Blood of the ſame Species with that of the

Masculinum; and though the Sexes be different, yet the Vessels are so far *Analogous*, as only to transmit Particles much of the same Nature, so that for *Colour*, *Consistence*, *Smell*, and all other Accidents, they are scarce distinguishable, the only Difference being in the *Vesicles* and *Vessels*. For as in some *Plants the Male Farina* and *Female-Seed* are only prepar'd by their Secretion and Reception into different *Tubuli*, from the same Pedicles in some Flowers, and from the same Juice: In other Plants *Tubuli*, analogous to these, separate or rather receive Particles of the same Nature, by which both *Male-Flowers*, and *Female-Embryones* are compos'd upon different *Pedicles* from the same *Sap*, and in the same *Plant*. 3. Though the *Male-Flowers* be upon different *Plants* in those of the same *Species* which produce the *Female-Embryones*, yet the *Male-Farina* performs the same Office in them, as if the *Male* and *Female* Parts were upon the same *Pedicle*, and in the same *Flower* of the same *Plant*. Just so, though *Male* and *Female* be different *Animals* of the same *Species*, yet the same *Seminal Matter* is perform'd or *elaborated* after the same manner in both.

Chymists tell us, that from an *Acidum* and an *Alkali* mix'd together, a *Tertium quid* results, partaking of the Nature of neither. *Tartarus Vitriolatus*, is a *Coagulum*, which neither partakes of the Nature of *Vitriol* nor *Tartar*;

tar; but in this Case, by the Coalition of a certain *Materies* from both *Male* and *Female*, the *Tertium quod* is not of a different, but of the same Nature with both, and is only a Continuation of the same *Species*. An Union of what has proceeded from the other two, so firm, that every thing incident to both Parents, often do's upon certain Occasions exert it self, and is frequently to be observ'd in one and the same Child, as is already declar'd.

I cannot upon this Occasion, but regret the Necessity I am under, of justifying *Nature* it self, and setting the manner of her Operations in a true Light.

Mr. *Morland* has thought fit, not only to embrace Mr. *Lewenhock*'s Sentiments concerning the *Animalcula in Semine Masculino*, but has endeavoured to find out somewhat Analogous to them in Plants too, by asserting, that the Seminal Plants are in the *Farina*, and to search after new and unpassable Ways, in order to confirm his Opinion.

It's not without the utmost Reluctancy, that I am forc'd in this Particular to stand up so much in Opposition to one of Mr. *Morland*'s *Character*, and who (I doubt not) deservedly, has gain'd so much the Esteem of Persons of Note and Distinction, because of his Learning, and other Curious and Ingenious Qualifications; but I cannot be so injurious to the Truth, as to conceal what is really Fact. Let any one but view and consider the

Figure he has given of the *yellow Lilly* (*Transact.* No. 287. Tab. Fig. 23. p. 1479.) and there they will see how he makes no less than nine *Apices*, supported by *Stamina* as small as Hairs, dance round a *Stylus* hollow at the top, and that all these *Apices* are in height equal to or above the *Stylus*, so that they can pour in their *Farina* into it, as it were into a Funnel; whereas the true Fact is, no *Lilly* has above six *Stamina* proportionally gross, supporting so many *Apices*, which, (as I have said) before the blowing, are near as long as the *Stamina* themselves (1) *Fig.* 1. *Tab.* 1. and never ascend higher than the Button; and instead of a hollow, or depress'd *Stylus* let any one attend to (1) *Fig.* 3. and there they may see a *Stylus* hollow indeed (*h*), but instead of being depress'd it is pretty much elevated at the top. If this Representation from the Life do's not please, I desire the Reader may satisfy himself in reviewing of the Flowers themselves next Year when they shall be in Season.

Nor has the *Curious*, *Accurate*, *and Ingenious Mr.* Bradly fail'd to become obsequious to Mr. *Morland*'s Sentiments, by bestowing not a vegetative, but even an animal and sensitive Life to every *Stamen* of a *Lilly*. (See his *Fig.* 1. to the first Part of the Improvements of Planting and Gardening, *pag.* 13.) where he makes the *Stamen* to arise voluntarily, stretch it self forth beyond the Length any *Stamen* (naturally speaking) ever yet

yet had in a *Lilly*, and to pour down the *Farina* upon a hollow top of a ſtrait *Stylus*; whereas it is for the moſt part bended upwards, and protuberant (*n.o.*) *Fig.* 1. All I ſhall ſay of theſe worthy Gentlemen is, that they have been reſolv'd to make uſe of an Axiom deſign'd for another Purpoſe.

Mihi Res, non me Rebus, ſubmittere conor. I have taken this Opportunity to demonſtrate quite the reverſe of what Mr. *Morland* contends for; not out of any deſire to contradict ſo Learned Gentlemen, but by making good the Analogy between Plants and Animals, that I may make it appear, if the Seminal Plant cannot be in the *Farina*, no more can the *Animalcula* become a *Fœtus*, and therefore if they had contented themſelves with going into Dr. *Grew*'s and Mr. *Ray*'s Sentiments, that the *Farina* is but a *Menſtruum* to convey the *prolifick Effluvia* toward the *Vaſculum Seminale* or *Semen*, they had improv'd the Doctrine of the *different Sexes* of *Plants* to a better Advantage, and People would not have been ſo much amus'd with novel Opinions, which only ſerve to pervert, and be a Maſk to diſguiſe the Truth.

For the Reader's Diverſion, I have hereto ſubjoin'd an *Ode* written in *Latin* in *Camerarius*'s *Epiſtle de Sexu Plantarum*, and literally tranſlated by a *young Botanick Student*, which as it contains an Abſtract of this *Eſſay*, I have been adviſ'd to inſert.

An ODE formerly Dedicated to *Camerarius* in *Latin*, and now presented to the Author: Being translated into *English* by *J. Martyn*, Φιλο-Βόλανικός.

TO sing new Loves, and new Desires,
Of am'rous Plants, *before unheard,*
As yet untrac'd by any Bard,
My wond'ring Muse aspires;

You that admire the Lyrick Strain,
And Joys of Venus *love to sing,*
Give Ear; thy Succours, Flora, *bring,*
I sing thy flow'ry Reign:

And ye, O Lovers, and ye Herds
Of am'rous Animals, *attend;*
Your chaste, melodious Voices lend,
You tuneful Choir of Birds.

When Winter's gone, and Spring succeeds,
With gentle Blasts Favonius *blows,*
The opening Flow'rs *each* Sex *discloses,*
And promise future Seeds.

The

The Stamina *with Meal abound,*
And when the gentle Zephyrs *blow,*
They from their double Summits *throw*
The Golden Duſt *around.*

Which born by the propitious Winds,
About the Female-Veſſels *ſpreads,*
And round the Pointal's *hollow Beds,*
A glad Reception finds.

No anxious Thought their Love deſtroys,
They want no ſable Night, to hide
The Bluſhes of the yielding Bride,
Fill'd with tumultuous Joys.

Hither the beauteous Lillies *bring,*
And the luxuriant Charms diſcloſe,
Of the too ſoon declining Roſe,
The Glory of the Spring.

There the Farina *we may ſee,*
Down from th'aſpiring Summits *flow,*
The greateſt part of Flow'rs *we know*
Hermaphrodites *to be.*

Now let us leave the flow'ry Plain,
And to the ſhady Woods retire,
The Catkins *of the Nuts admire,*
Which pour down ſulph'rous Rain:

Let us behold the lofty Pine,
That part whereon the Fruit *appears,*

Is Female; *that which Flowers bears*
Is Male, *both* Sexes *join*;

As Shell-Fish in the briny Main,
At the same Time from one part give,
What with the other they receive,
Both Sexes *they contain.*

Not thus the verdant Laurel *fares,*
The noble Palm *and* Juniper,
For on those Trees *which* Flowers *bear,*
No shining Fruit *appears:*

And those, upon whose Boughs we find
The Fruit, *no tender* Flow'r *can shew;*
Thus we the different Sexes *know,*
Of Beasts, *and all Mankind.*

If any farther Doubt appears,
Those, who to jolly Bacchus *bow,*
The twining Hops *with Pleasure know,*
Which ease them of their Cares.

The Mercury *both* Sexes *shews;*
And Hemp, *which pays with double Gains,*
The Labours of the weary Swains,
Both Male *and* Female *knows.*

Thus when her Eggs *a* Hen *conceives,*
If the fierce Cock *his* Female *treads,*
A living Off-spring then succeeds,
No fruitless Egg she grieves.

But

But if her abſent Lord *ſhe mourns,*
A fruitleſs Egg the Widow bears,
No living Off-ſpring then appears,
Till her lov'd Spouſe returns.

So Fiſh, that haunt the ſtormy Main,
By bounteous Nature taught, o'erſpread
The Female's *Eggs with genial Seed,*
Nor can the Waves reſtrain.

So when the Pointal's *hollow Beds*
Are cover'd o'er with Golden Meal,
With growing Fruit *the Caverns ſwell,*
And promiſe future Seeds.

On the ſame Plain each Sex *is found,*
The ready Wife conceives the Seeds,
When the propitious Zephyr *ſpreads*
The gen'rous Duſt around.

But if the Apex *you remove,*
Or raviſh from the Husband's Arms,
The Virgin Bride's unſpotted Charms,
The Flowers will fruitleſs prove.

Sometimes the Female *ſtrives in vain,*
To form th'abortive Seeds, *why ſhould*
The double Flowers *then be proud,*
Since they no Seeds *obtain.*

Oh! with what Joy my Eyes behold
The wond'rous Frame of Nature's Laws!

How

How my aſpiring Thoughts rejoice,
Theſe Myſteries to unfold!

Great Man, thy glorious Theme *purſue,*
Whilſt thee th' attentive World admires;
All other Breaſts thy Glory fires,
To trace what former Ages never knew.

Almighty God, who did'ſt the World create,
And from an empty nothing form us all,
Preſerve this glorious Order we entreat,
Until the World decays, and Stars from their
(exalted Seats ſhall fall.

BOTANICK ESSAYS.

ESSAY V.

Of the Nouriſhment of Plants.

THE next Branch of the *Analogy* betwixt *Plants* and *Animals*, is their NUTRITION. It may be admir'd how prying and inquiſitive Perſons ſhould ſtill be ſo ignorant of the *Circulation* of the *Sap*, or *Nutritive Juice* of *Plants*, if the World had not remain'd ignorant for many Ages of a *Circulation* of the *Blood* in *Animals*, before the famous Dr. *Harvy* diſcovered it. The great Obſtacle I ſuppoſe, for finding out the ſame in Plants

Plants too, must be the want of a due Consideration of this *Analogy*, the Inconveniency of dissecting the *Succiferous Vessels* in *Plants*; and the *Sap* being of the same Colour with the Vessels, unless it happen sometimes to be *milky* and *white*. The *Celebrated Malpighi*, and the above-nam'd Dr. *Grew*, though they most accurately enquir'd into, and examined the Structure of all the Parts of the Plants, and curiously delineated them, yet they were still deficient in a right Notion of the Motion of the *Sap*, though their Dissections, and Means they us'd to discover the Vessels, are no small In-let to the Knowledge of it. I shall not repeat what they have judiciously advanc'd upon the Subject; for that would be *Cramben bis coctam pergere*, but refer the Reader to their accurate Writings and Figures [a], and proceed to supply what I suppose they have been deficient in, upon the Subject.

I shall therefore first consider the Seed it self, according to the Sentiments of some Ingenious Authors, before it begin to chit or germinate. Its Progress in the Germination, and the Circulation of the Sap after it has chitted, germinated, or budded.

Josephus de Aromatariis, is the first, by what I can understand, who came to the true Knowledge of the *Folia Seminalia* or Seed-

[a] Marcel. Malpigh. Anatome Plant. Lond. 1675. Fol. Dr. Nehemiah Grew, Anatomy of Plants, Lond. 1682. Fol.

Leaves

Leaves being pre-exiſtent in the Seed before it was committed to the Ground, which becauſe he has the ſame Opinion of the Neceſſity of a Spirituous *Materies* to fecundate the Seed, as *Sennertus*, who I doubt not borrowed it of him, I ſhall inſert an ingenious Letter writ by that accurate and expert *Botaniſt*, *Paul Boccone*, to Dr. *Tournefort*, upon that Subject. Thus

Theſe, called the Seeds of Plants, are not truly Seeds, neither have they that (Vis, actus & Potentia) *prolifick Action, Virtue and Power* (*as they call it*) *to generate a Plant. But ſince this may ſeem obſcure to many, I ſhall unfold the Myſtery: A* Plant *in due Time generates a fertile Seed, correſponding to the* Seeds *of* Animals, *from a certain* Materies *or Subſtance, mix'd with ſpirituous Particles.* 2. *This is ſeparated in thoſe called* Seeds, *or* (*as* Empedocles *calls them*) *the* Eggs *of* Trees. 3. *The encloſed Spirit in thoſe Places acts more ſtrongly upon the groſſer Matter, and always encreaſing, ſubdues the groſſer Particles, ſo that from its principal Part a moſt minute Plant is truly generated. The* Organs *being thus determined, this* vivifick Effluvium, *or* Spirit *in the* Plant, *renders them diſtinct, and proportionally configurated. But it ſeparates the groſſer Particles, to be receiv'd as Food by this configurated and faſhioned Plant.* 4. *The little Plant, generated in thoſe called Seeds,*

s either begot in that part to which the Pedicle adheres, or an oppoſite part, or ſomewhere elſe. 5. *That Part to which the Pedicle adheres, is ſtretch'd forth in order to compoſe the Pedicle or Fiber of the* Root; *from its oppoſite Part or Top do proceed the* Leaves. 6. *If it is generated towards the top, the* Leaves *are ſtretch'd forth towards the* Pedicle, *and the* Root *towards the top.* 7. *The ſmall* Plant, *thus generated, lives, is nouriſhed and augmented, and in due Time it decays, and as a ſuper-annuated Animal (as it is called) dies of old Age:* 8. *Several of theſe Plants while they remain lurking in the Seed, are nouriſhed by ſome adherent (as I may call them* Umbilical) Veſſels. 9. *That the* Seeds, *which contain this, begot or configurated* Plant, *are* fecundated; *but theſe, which do not contain it ſo configurated, are* barren; *nor can they by any Means be rendred* fertile. 10. *Thus the new Plant grows up and encreaſes, when put into a convenient Place; but it is not then begot.* 11. *For the* Generation *of a Plant is perform'd by* Concoction. 12. *The* Origine *of a* Plant *is, when the Particles are attenuated, and when the Nouriſhment is concocted.* 13. *There is a Milk in thoſe called Seeds, provided at the* Origine *of a* Plant, *and deſtin'd for its Nouriſhment, that it may encreaſe and augment.* 14. *The* Plant *thus begot, receives no more Nouriſhment, ſo prepar'd from that which*

is

is called Seed; *but after it falls off from its Mother Plant, it remains in that Condition until it be committed to the Ground,* where *it may chit and ſpring forth.* 15. *Nor do's it receive any more Nouriſhment by the Umbilical Veſſels, but by the Root*; for as an Animal *is nouriſhed by the* Umbilical Veſſels *in the* Uterus, *or before the* Birth, *but when brought forth it is nouriſhed by the Mouth*; *ſo thoſe called the Seeds of Plants, receive no more Nouriſhment after they are ripe, by the* Umbilical Veſſels *or* Placenta, *but by the Root* [a].

Boccone ingenuouſly acknowledges he had this from a Book called *De Rabie Contagio*, written by the above-named *Joſephus de Aromatariis*, and printed at *Venice* 1625.

Dr. *Grew* is the next who I find has accurately deſcrib'd theſe *Folia Seminalia* in a *Bean*, which he ſays conſiſts of three conſtituent Parts. The *Radicle*, which is obſervable near to that part call'd the *Eye*, is a white Point, oppoſite to a ſmall Hole or *Foramen*, which penetrating the *common Cover*, may be obſerv'd by the naked *Eye* in a green *Bean*, but more-eſpecially by a Magnifying-Glaſs it will admit of a ſmall wire. The *main Body* conſiſts of two *Lobes*, which filling up the whole Capacity, are thick and carneous in

[a] Boccon. Plant. rarior. Sicil. Obſerv. 8. p. 61. Edit. Venet. 1697. 4to.

this *Seed*, being closely united and join'd together before the *Germination*. Betwixt these *Lobes* lies a small Substance, crumbl'd and wrap'd up together like a Feather, and therefore Dr. *Grew* calls it the *Plume*. The *Radicle* is the beginning of the *Root*, the *main Body* or two *Lobes*, when afterwards spread forth, become the *Folia Seminalia*, or *Seed-Leaves*, and the *Plume* is the *Rudiment* of the next Pair of *Leaves*, after the *Seed-Leaves* are decay'd. The *Seed* thus compos'd, is inclos'd within two common Membranes, the outer thin, and the inner thicker; and one proper, which covers both the out-side and in-side of the *Lobes*, as also the *Radicle* and *Plume*. The *Plume* do's not appear in several Plants, until the *Seed-Leaves* have been spread forth for some time. Who would be farther satisfy'd about these, may consult Dr. *Grew*'s valuable Treatise, called *The Anatomy of Plants* [a]. Mr. *Morland* pretends to the Discovery of the *Foramen*, but Dr. *Grew* gave the above Description of it Twenty Years before he wrote. Neither of them have assign'd the true use to it, as shall be shew'd hereafter. The *Fructus Linguiformis*, as *Tournefort* calls it of the *Ash-Tree*, shews the *Radicle* and *two Seed-Lobes* very plainly, if after it has lain a Year in the Ground (for it do's not chit until the

[a] Lib. 1. Ch. 1. Fol. Lond. 1682.

second

ſecond Seaſon) you ſtrip it of its outer Coat, you may obſerve the Point of the *Radicle* at the thick End, oppoſite to the above-nam'd *Foramen*, by which it had communicated with the *Pedicle*. From thence the *Radicle* runs to the other End, where being folded, it is divided into the *two Lobes* which begin there, and return where the *Radicle* began, and there they terminate. Dr. *Grew* gives a very good Method for finding this *Hole*, which is by ſteeping the Seed ſometime in Water, and then ſqueezing it, you may obſerve how the Water flows out of the Hole.

Before I begin to diſcourſe of the *Vegetation* of the *Plants*, it is fit I premiſe ſome general Conſiderations. And, as to the *Elements*, they are, 1. The *Earth*, to which the Seed is committed; this is that which is called by the Chymiſts *Caput Mortuum*. 'Tis a Compoſition of ſtiff or rigid, groſs, immoveable, heterogeneous Particles, ſtrictly united, and cloſely combin'd, uncapable to act or perform any thing of it ſelf, unleſs mix'd with a due Proportion of Water (according to that Axiom of the Chymiſts, *Salia non ſaliunt niſi in Fluido*) and ſet in Motion by the heat of the Sun, or ſome other artificial Heat. 2. Water is a thin, tranſparent, fluid Subſtance, whoſe Particles are ſo eaſily ſeparable, that they are ſoon divided, by which it can inſinuate it ſelf into moſt minute Pores, and penetrate into the moſt intimate Subſtances, ſo that it is capable to extricate and carry along the moſt

active, volatile, tenuious, and subtile Particles of the *Earth*, and dispose them to be set in Motion. 3. The *Air* is a thin, rarify'd Body, consisting of such tenuious Particles as ascend from the Earth and Water, and capable of so swift and rapid a Motion, that it can carry every thing that's loose before it; when such Particles as are more Light, are receiv'd into its Body; and such as are more ponderous, and which cannot be suspended by so rarify'd a *Menstruum*, fall down, and return to the Earth from whence they came; so that whether we consider the *Earth* simply taken, as a Body of firm, solid Particles closely united, or the *Water*, as having fluid, condens'd Particles, capable to insinuate themselves into the Pores of the former, or the *Air* rarify'd, suspending what is receiv'd as more fit for Motion from the *Earth* or *Water*, we may look upon all these to be most conducive for the Growth and Encrease of Plants.

I have chosen to give this coarse Idea of these three Elements, the better to explain the *Vegetation*, without enquiring, whence this Motion of Particles proceeds? What it is we call the Heat of the Sun? What are the Principles of Gravitation? Why those call'd lighter Bodies ascend, and the more ponderous descend? What is meant by Fluidity, Condensation, Rarefaction, *&c.*? Whether there be a *Vacuum* or not? Wherein consists the Pressure of the Atmosphere? Why the Pores of Animal and Vegetable Bodies are said to be shut

in

in cold, and open in hot Weather? Wherein that which we call Coldneſs conſiſts? Theſe being Philoſophical Queſtions, do not ſo properly come in here, where I am to expreſs every thing in the moſt plain and intelligible manner. I ſhall only add, That as the three Elements above-nam'd contribute to the Nouriſhment, Preſervation, and Production of all ſublunary Beings, ſo the fourth, which is Fire, is the means of their Deſtruction, by violently diſuniting and diſingaging of the Particles formerly combin'd, in which the Diſſolution of every thing conſiſts; for as the compoſure of all kind of Subſtances depends upon the Union and ſeveral Diſpoſitions of the heterogeneous Particles, and different Configurations of their Pores, ſo whatever is inſtrumental in diſſolving of this Union, tends to the Deſtruction of the Body. And as that which we call Cold depends upon a more than ordinary *Quies* of all the Particles, ſo their being ſet in a mild and ſlow Motion, gives the Idea of *Warmneſs*; and when they are mov'd more quickly, or in a more intenſe Degree then we feel that which is called *Heat*: Whereas when the Particles are mov'd and agitated in the moſt vehement, rapid and intenſe Degree then that which is call'd *Fire* is produc'd. And whereas it tends to the Deſtruction of Bodies, ſo the other two, *viz.* *Heat* and *Warmneſs*, cheriſh and enliven them. It is alſo in a ſmooth and pleaſant Motion of Particles that *Life*,

and in an intire Ceſſation of this Motion, that *Death* conſiſts.

2. I ſhall not deſcend to the particular Conſideration of the Particles themſelves, nor condeſcend upon their different Figures. Neither ſhall I endeavour to determine the Configuration of the Pores or Interſtices betwixt them. I need not have Recourſe to the *Chymical Principles*, nor offer to ſum up all the various *Oils*, *Salts*, *Phlegms*, *Spirits*, *Sulphurs*, *Nitres*, *Acids*, *Alkali's*, *&c.* which are ſuppos'd to enter into the Compoſition of that Variety of Animals and Vegetables that are upon the Earth, nor explain whence this diverſity of *Taſtes*, ſuch as *bitter*, *ſweet*, *ſalt*, *hot*, *acrimonious*, *&c.* proceeds, any otherwiſe than to ſuppoſe they are the Effects of the ſeveral Particles ſo and ſo combin'd, which variouſly affecting our *Tongue* and *Palate*, afford us the different Idea's of theſe ſeveral *Taſtes*.

In a word, As the *Materies Mundi* conſiſts of an unconceivable Variety of differently configurated *Particles*, ſo all the various Subſtances which make up the Fabrick of this *Earthly Globe*, and whatever corpuſcular Beings are either in, or upon it, ſeem only to depend upon their different Combinations, and different Proportion, according to their ſeveral Configurations, by which their Pores and Interſtices muſt be ſo fram'd, as only to admit of Particles of ſuch a Figure, as they may enter into other Pores of the like Configuration;

guration; and being thus adapted to Particles of that ſame Figure, they ſerve to extend and augment the *Bodies* of ſuch and ſuch a Compoſition and Texture. Thus we ſee in a Bed of Earth or Mold, prepar'd and dreſs'd up according to the Art of the *Gardiner*; if there be a handful of ſeveral Sorts of Seeds ſown in it, every *Species* of them ſhall chit, and become a Plant, all which ſhall be of different *Genera*, *Species*, *Taſtes*, *Virtues*, &c. and yet proceed from the ſame Earth; and the Reaſon is plain, becauſe the Pores of their Roots being certain minute Cavities, circumſcrib'd by the ſeveral Particles of ſuch and ſuch Figures, they can admit of no other into their Capacity, but ſuch as are of the like Configuration. When theſe Things are duely conſider'd, there will be no need of having recourſe to *Suction*, *Attraction*, *Fermentation*, *Concoction*, *Digeſtion*, &c. For there is nothing more requir'd here in a *Plant*, than that it be plac'd in Ground ſuitably prepar'd, and in an agreeable Soil; that it have convenient Depth in the Earth, and a ſufficient Space to extend the Fibers of its Root; and then, as the Particles aſcend, being ſet in Motion by a ſeaſonable Heat, they enter the Pores of the Root capable to receive them; and thus they encreaſe and augment the *totum Compoſitum* of the *Plant*; and this is no more than the accidental intercepting of ſuch Particles, which otherwiſe might have eſcap'd into the open Air.

This being a very easy and natural Basis upon which the Vegetation of Plants, hitherto look'd upon as so difficult, may be founded, I hope to explain all the different *Phænomena* which can be reasonably propos'd by the same.

As in the last *Essay*, I explain'd the Manner of preparing the *Farina*, until it was ripe, and capable to *fecundate* the *Seed*: Now I come to the Preparation of the *Seed* it self. All *Seeds*, as *Josephus de Aromatariis* well observes, have an *Umbilical-Vessel* or *Placenta* to nourish them from their first Formation till they be ripe. These *Placentæ* are either common to a great many, or proper to every single *Seed*, not but that in these common *Placentæ*, each Seed has the Orifice of a Vessel peculiar to it; but they are more closely join'd together in the common, and more distinct and farther separated from each other in those I call proper *Placentæ*, *v. g.* In the *Papaver Capitatum*, or *Garden Poppy*, there are several *Laminæ*, which arising from the Sides of the *Capsula*, and running towards the Center, have the Seeds thick set in each Side, as it were indented or fix'd in them, as the Teeth are in the Jaw *per Gomphosin*, as the *Anatomists* call it; and here is a wonderful Contrivance for the Preparation or Percolation of the Particles of which the small Seeds are to be compos'd. The milky Sap flows in great Abundance up to the Pedicle. At the Articulation

Articulation below the *Capſula* or Head, it is receiv'd into a great Variety of ſmall parallel *Tubuli*: Theſe aſcending along the ſide of the *Capſula*, diſperſe the Sap into every one of the different *Placentæ*. Theſe are again ſubdivided into a great Number of yet ſmaller *Tubuli*, which run directly to the particular *Semina*, ſo that it is eaſy to ſuppoſe this Seed muſt be the very Quinteſſence of the whole Plant, when the Sap, which nouriſh'd it muſt have paſs'd ſo many different Chanels before it could arrive at it. How fine and delicate muſt theſe *Tubuli* be which muſt paſs through the minute Pores of the *Seed*, frame the *Radicle*, two fine, ſmall *Seed Leaves*, and the common *Tunicle*? How admirably is the *Pedicle* articulated with this Head, which will no wiſe ſeparate from it until all the Seeds be fill'd? For the *Stalk* will rather break by Force than the Head can be pull'd from the *Pedicle* by the Articulation, before the Seeds are ripe. This is exactly analogous to the *Placenta* in *Animals*, for ſo ſoon as the *Ovum* has drop'd into the *Uterus*, then this adventitious *Placenta* and *Navel-String* begin to be fram'd by an Elongation of the *Capillaries* of the *Hypogaſtrick Arteries* in the *Uterus*, where it forms the *Capillary* Extremities of the *Arteria Umbilicalis*, which conveys the Blood to the *Fœtus*; but no ſooner do's the determinate Time of the *Birth* approach, than theſe *Capillaries* pleaſantly ſeparate from each other

without any extraordinary flooding: Whereas at an *Abortion*, or an *untimely Birth*, this flooding is usually extraordinary, and the Vessels are, as it were, torn from each other. Thus the Seeds so soon as they are fill'd and ripe, quit their hold of the *Placenta*, as a Leech falls down from the Orifice it had made in the Skin, when it is glutted with Blood, or as the Navel-String of most Animals, Quadrupeds especially, drops of its own accord when the *Fœtus* is brought forth. This is more observable in large Seeds, which have separate *Placentæ*; such as *Peas*, *Beans*, *Phaseoli*, *&c.* where there is, as it were, a common *Navel-String* running from the *Pedicle* to the point of the long *Siliqua* or *Pod*, and at every certain Distance there is a small Production or *Placenta* for the Nourishment of each *Seed*. This *Placenta* is proportionably large enough, and adherent to the Eye of the *Bean* or *Pea*, by a certain Viscosity, and sends forth two Kinds of Vessels, the one to nourish the common *Tunicles*, which being distinct from the Seed it self, is not nourish'd by one and the same *Vessel*; for that which nourishes the Seed is an Elongation of the *Placenta*, which penetrating the common *Tunicle*, by the above-named *Foramen*, terminates in the point of the *Radicle*, which from thence conveys the Nourishment throughout the *Lobes* and *main Body* of the *Seed*, and what is superfluous returns by the venal Duct

Duct to the *Placenta.* In naked, whether they be *Polyſpermous* or *Monoſpermous, Seeds,* each has a particular *Placenta* from the *Pedicle.* This Elongation of the *Placenta* through the *Foramen* is obvious in the *Monocarpi,* as in the fore-named *Aſh-key,* where the Point of the *Radicle* is no other than the broken Extremity of that Veſſel of the *Pedicle* which nouriſhed the *Seed,* being continued through the Perforation of the *Outer Coat.* This affords us a pleaſant Speculation of the wonderful Providence of Almighty God, that one Species ſhould be as it were, only a Continuation of the other; for the Seed at this Rate, is no more than a detach'd *Germen* or Bud of the Tree, which being fram'd by, is nouriſh'd along with it, as being *Bone of its Bone, and Fleſh of its Fleſh,* until it has acquir'd a convenient Bigneſs, and can purchaſe Food for it ſelf, being ſufficiently provided with a *Mouth.*

This renders the Idea of the Chitting or Germination of the Seed very eaſy. Here we ſee a Plant already form'd, having Root and Leaves, which as *Sennertus* well obſerves, after it is detach'd from the Mother Plant, is capable to ſubſiſt of it ſelf, without fading, being cover'd with, as it were, a Coat of Mail, or ſufficient Armour to guard and defend it, whereas no other part, being pull'd from the Plant, do's ſo, but dies immediately when it is committed to the Ground. Although

though it die from being a Seed, yet it lives to become a Plant; and that very Veſſel by which it received Nouriſhment from the Mother-Plant, is now employ'd to receive it in like manner from the Earth; for the Point of the *Radicle* is no other than the broken Oriſice of the *Pedicle* or *Placenta* of the Mother-Plant. And now the Particles in the *Seminal Plant* being ſet in Motion by the Subterraneous Heat or Warmth, this Orifice is dilated and rendred capable to receive an additional Supply of new Particles from the *Earth*. This *Foramen* is here of ſpecial Uſe, for the nutritive Particles in their aſcent have free acceſs to the Orifice of the *Radicle*, they having once begun to flow, one Particle is ſucceeded by another, until they reach the Reduplication of the *Radicle* where the two *Lobes* are form'd, whence they paſs to their Extremity; where being confin'd by the common Tunicles of the Seed, they form new Chanels, by which they return with greater Force, being continually follow'd by a new Succeſſion of Particles; ſo that ſeveral of them being impacted in the Interſtices, betwixt thoſe which formerly compos'd the *Radicle*, it is by this Means ſtretch'd forth; and being at greater Freedom, dilates the *Foramen*, and is extended far beyond it. When theſe *Particles* have arriv'd at the thus ſtretched forth Extremity, they frame new *Veſſels*, by which they return again to the Extremity

of

of the two *Lobes*; and thus, by the reciprocal Progreſs and Regreſs, they ſtretch forth the *Radicle* on the one hand, perhaps two or three Inches, and enlarge the two *Lobes* ſo far on the other, that the outer Coat not being able to contain them any longer, they burſt and fall off; and thus the *Folia Seminalia* lift up the Head, extend themſelves, and appear above Ground.

And here the ſpecial Uſe of this *Foramen* appears. "There is no Neceſſity of any "airy Particles which may obtain an Entry "through this Hole to excite a Fermentati- "on, or for any ſuch Particles or Steams which "might damp the genuine Proceeding of it "to paſs out that way, as Dr. *Grew* would "have them. Neither is this Hole ſo ſituated as to admit of the *Seminal Plant* from the *Farina*, for I have already ſhew'd how unacceſſable it is for it to enter the Seeds of the ſiliquous Plants, and Mr. *Morland* muſt have a ſtrange Idea of it, when he makes this *Seminal Plant* to be a diſtinct Body, from the two *Lobes* of the *Bean* already form'd; and at its full Bigneſs, *as in* Fig. 26 *of the before-cited Tranſaction*. Sure if he had conſulted Dr. *Grew*'s Diſſection of the *Bean*, and even the Dictates of Nature it ſelf, he would never have ordered ſuch a Figure to be delineated: Nor do I ſee what he can mean by ſuch a Repreſentation of a *Papylonaceous Flower*. *Fig.* 24. Dr. *Grew* ſpeaks of an inner Body, which

which is one entire Body in a good part of the *Radicle*, towards its *Base*: That it is divided into three main Bodies, the middle running directly to the *Plume*, the other two on each side passing to the *Lobes*. For my part, as I am loath to gainsay so accurate an Inspector into the Structure of the several Parts of the Plant, so I see no great Necessity for establishing this inner Body; for as I am convinc'd that the Juice at the beginning may circulate several Times betwixt the *Radicle* and the *Lobes*, until the Particles are sufficiently attenuated and prepar'd by passing through the several *Capillaries*: So when this is done, they tend no more laterally, but ascending perpendicularly in the Center, as the most attenuat Particles of all Liquors do, by degrees it stretches forth and extends the *Plume*, until the two *Leaves*, of which it is compos'd, are fully expanded. From henceforth the Sap taking a perpendicular Course in its Ascent, and forsaking its former Road, the *Lobes* or *Seed-Leaves*, decay apace, as these of the *Plume* are augmented, until the one is withered away and dies, while the other pushes forth a Stalk directly from the middle, betwixt them. That this may be the use of these *Seed-Leaves*, is very evident; for, if after the *Plume* has appear'd, and while the *Seed-Leaves* are yet strong and juicy, you shall tear them off, the *Plume* in the middle will decay; whereas, if they are allow'd to remain, when the *Plume*

is

is become ſtrong, they fall off of themſelves.

Thus we may eaſily conſider the Progreſs of the Seeds in the ſeveral Steps of their *Vegetation, viz.* How this Point of the *Radicle* receives its Nouriſhment by the Orifice of the broken Extremity of the *Pedicle* or *Placenta* formerly contracted, now dilated. How the *Seed-Leaves* come to be extended? And how by a daily receiving of a new Supply of Particles continually circulating in their proper Veſſels; firſt the *Radicle*, then the *Folia Seminalia*, are extended and augmented in their Turns, until the *Plume* is expanded and becomes ſtrong; after which theſe *Seed-Leaves* fall off. So that now the Circulation is continu'd from the *Root* to the bottom Leaves and Stalk, from thence to the Root again, where, by a reciprocal Circulation, theſe two are extended and augmented in their Turns; and when the *Root* is enlarg'd in its Capacity, then the *Orifices* which receive the nutritive Particles, encreaſe in their Number. For as in the Nipple of a *Woman's Breaſt*, the Milk flows out by different Streams from the *Tubuli Lactiferi*, ſo here by ſeveral *Tubuli* is the *Sap* admitted. This Admiſſion, Reception, and continual *Circulation* of the nutritive Particles ſeems to be ſo very eaſy and natural to conceive, that I cannot but admire, how, having ſo fair an Example as that of the *Circulation* of the *Blood* in *Animals* before them,

this ſhould have lain ſo long in the Dark, and hid even from Perſons of great Penetration? How much the want of the due Conſideration of it has puzzled them, rack'd their Wits, made them run into abſurd Notions, and entertain ſuch ſtrange and wonderful Idea's of the Vegetation, is ſufficiently to be ſeen in their elaborate Writings.

Since its plain, that there is a natural and continual aſcent of Particles from the Earth: If there is a Pore in the Extremity of the Fiber of the *Root* of a *Plant* perpendicularly ſituated above the Place where they aſcend, is it not as natural to conceive a Particle may enter, where, by a *Tubulus* leading ſteightway from this Pore, it may aſcend freely, as to ſuppoſe that thoſe Particles which lie deeper *in gremio Terræ*, do by the Heat of the Sun gradually aſcend towards the Surface of the Earth? If there is acceſs to one Particle, we may believe there is alſo acceſs to others ſucceeding it, which continue to follow the ſame Path ſo long as there remain any perpendicularly below, which can have eaſy Admiſſion into ſuch a Pore. If again, inſtead of one Extremity of a Fiber we are to ſuppoſe 1000, 10000, and ſo on in ſome Plants, and that the *Tubuli* from theſe Pores or Orifices do all unite and join together, in order to compoſe one or more Trunks of Veſſels, it is eaſy to imagine, how by the continual Accretion and Succeſſion of theſe Particles, at Length a Liquor may be form'd,

form'd, capable to fill up and poſſeſs all the different Chanels of the Plant, until it arrive at the Extremities, where theſe Trunks are again divided and ſubdivided into ſmaller *Tubuli*, until they come to a *ne plus ultra*. And ſince we may ſuppoſe theſe Pores may be pretty patent and open at the Root, where groſs, crude, undigeſted Particles may enter, whence flowing into larger and larger Capacities, they cannot as yet be rendred ſo tenuious as to paſs into the moſt minute *Tubuli* of the fine Pedicles and Flowers: Therefore, without having Recourſe to *Concoction*, *Digeſtion*, or *Fermentation*, we need no more than to ſuppoſe them firſt to aſcend, then to be forc'd up by a continual Succeſſion of following Particles, until they come to the fore-ſaid *Anguſtia*, that they muſt enter the narrow Chanels, or elſe ſtagnate or heſitate there. It is eaſy to ſuppoſe, how by rubbing againſt the ſtiff ſides of the Pores, and narrow *Tubuli* through which they are to paſs, they may be ſufficiently attenuated, rendred more and more ſubtil, and made capable of being admitted into the fineſt *Capillaries*; and if any of them by this Friction, are ſo attenuated that they cannot be well adapted to the Pores at the ſides of the *Tubuli*, to contribute towards the Accretion and Growth of the Plant, theſe paſs out at the Extremities, and flow into the common Air; ſuch of them as can be receiv'd into the Pores betwixt two Particles of the ſolid Sub-

ſtance remain there; and theſe that ſtill continue to be too groſs, return, in order to be mounted again in their Courſe by another Circulation. And thus the vegetable, as well as animal Bodies, are augmented, and do encreaſe, the one by a continual, *uninterrupted Circulation* of the *Sap*, as the other of the Blood throughout the ſeveral Veſſels, and *nutritive Tubuli*.

I am next to conſider the different Subſtances of Plants. They are either Herbaceous, or Ligneous and Woody. The Herbaceous conſiſt for the moſt part only of two Subſtances, the *Parenchyma* and Marrow, and ſometimes they have no Marrow at all, but are only hollow. This *Parenchyma* of the Herb conſiſts of the ſame looſe Texture of parallel *Tubuli*, endow'd with ſeveral large open Pores tending horizontally, or inclining outward, as the *Bark* of *Trees*, and is only covered with a very thin, extended, membranous Subſtance without, as the *Cuticula* covers the Skin in humane Bodies. Here the Sap aſcends with the greater Freedom, and in greater Abundance. Hence it is that ſuch Plants, generally ſpeaking, have their flowering Time, and the Time of perfecting and ripening their Fruit and Seed in one Seaſon. After which the whole Surface, *i. e.* Stalk and Leaves, die immediately. If the Root which becomes hard and woody towards the latter end of the Seaſon, dies too, then it is called an

an annual Plant, and is no wiſe propagated but from the Seed. In others the Surface only withers and decays, and the Root remains lively and carneous, and then it is called a perennial Plant. The part whence the Stalk aroſe in theſe is ſhut, and as it were block'd up, ſo that nothing proceeds from thence any more; But new Buds ariſe in the *Autumn*, (as the aſcent of the Sap by the former Stalk ceaſes) which are augmented and become ſtronger, by the framing of a Courſe of new parallel *Tubuli*, by the continual aſcent of the Sap towards it, and by the return of the Sap it ſelf towards the Root. So that by a reciprocal Circulation theſe new *Tubuli* are prepar'd and augmented, and the Bud is diſpos'd to puſh forth new Shoots in the Spring: And whereas there aroſe but one Stem the firſt, ſometimes there will be two, three, or four next Year, and ſo on, as may be ſeen in the *Bryony*, &c.

In the annual Plants, ſome have a fibrous Root: Theſe do generally prepare very ſoon for the Stalk, in order to which, after the *Radicle*, which is long and ſmall, has ſtretch'd it ſelf two, three, or four Inches perpendicularly downwards. Then it emits a great many ſmall Fibers obliquely round it, that it may receive the nutritive Particles every where from the Circumference, and convey them to the Center; whence aſcending perpendicularly, it ſtretches forth a few bottom Leaves;

and the ſuperfluous Sap returns to the Formation of more Fibers. Thus the Sap continues to aſcend and deſcend for the ſpace of two or three Weeks, the Stalk mounting but little all this while, and the greateſt Proviſion being made for the Fibers of the Root. For as the firſt Work of the *Bee* is to form the Honey-Comb, or thoſe Caverns in which the Honey is to be lodg'd: So in the Vegetation of the Plants, the firſt Step is the Formation of the nutritive *Tubuli*, and fibrous Receptacles; and the bottom Leaves in this Caſe, are like the circulatory Veſſels, which the *Chymiſts* uſe, when fixing one *Matras* upon another, and placing it in a Sand-Furnace, they make the Liquor to aſcend by a gentle Heat to the top, from whence it returns to the bottom, and by its circulating after this manner for ſome time, the Tincture is extracted from harder and more compact Bodies. So here the Plant does not ariſe to any height, until by frequent Circulations from the Root to the Leaves, and from the Leaves to the Root, the Sap already entred be better prepar'd, and convenient Veſſels be form'd for the Admiſſion of more. The *Corona Solis*, or Sun Flower, is a pregnant Example, where from one pretty large Seed, being for the moſt part $\frac{2}{3}$ of a Grain Weight, the Seed-Leaves being gone, the bottom Leaves augment in their Number by Degrees, and encreaſe in their Bigneſs for the Space of two Months, while the Fibers of the Root are a

forming, and Proviſion is making for a larger Quantity of the Sap. And as there will not all this Time be above four or ſix Leaves upon the Surface of the Plant above Ground; ſo there will be a vaſt Number of Fibers ſtruck out below. And here is a pregnant Proof of the Circulation of the Sap, from the different Poſition of the Fibers of the Root, from the Pedicles of the Leaves, and Branches of the Stalk; for whereas in the Root, all the Fibers deſcend obliquely from the principal Trunk, no ſooner is the Surface above Ground form'd, than the Pedicles, Stalks and Leaves aſcend, which muſt needs proceed thus: When the Sap is receiv'd from the Earth, it aſcends and puſhes out the upper Surface. What is ſuperfluous returns, and from the Parallel *Tubuli* in the Center of the Root, tends laterally, and frames new Chanels, which are ſtill more ſtretch'd forth, according to the Proportion of the Sap; for we are not to ſuppoſe that ſo ſoon as the nutritive Particles are receiv'd at the Extremity of the Fiber, and admitted into the *Tubuli*, which compoſe the principal Trunk, they ſhould immediately form an Angle, and deſcend ſtreightway towards the Earth again, ſtretching forth the Fiber of the Root all along as it paſſes; but its more eaſy to conceive, that after the Sap has aſcended towards the Surface and Extremities of the Leaves, Stalk and Branches, it returns more ſpeedily, and with greater Force, for *Facilis Deſcenſus Averni*, and conſequently

when it comes to the Root, tends laterally, and frames the obliquely descendent Fibers.

In the *Carneous* or Parenchymatous *Roots* of those called *Annual*, though generally speaking they are biennial Plants (for one Season is spent in the Formation of the Root, and the second Season in Perfection of the Seed, and then they decay) though some of them, as the Radishes, both form the Root and produce the Seed in one Season: In these, I say, the case seems to be different, for they make all the Haste and Provision they can to frame the Root first, only by pushing out some bottom Leaves, for the more regular Performance of the Circulation. The manner of their growing I take to be thus: The Point of their *Radicle* is at first pretty large, and capable to receive a good deal of Sap, and of Particles pretty gross, the more subtile ascending perpendicularly, go towards the Nourishment of the Surface, while the more gross and aqueous tend laterally, and form the *Parenchyma* or carneous Substance of the Root. The nutritive *Tubuli* in their Ascent, form an Arch, and are bended inwards, and descend again without entring the Surface; and thus continuing by Degrees, till the more subtile Particles of this lateral Sap, in its Descent, approaching nearer the Center, when perhaps, after their second or third Circulation, they are receiv'd into

into the parallel *Tubuli*, which convey them ſtrait towards the Surface. This is very eaſily demonſtrable in a Turnip, where 'tis generally obſerv'd, that the biggeſt Root has the leaſt Top; and where contrary to moſt of other Parenchymatous Roots, the carneous Subſtance is more ſpongy, leſs ſubtile and wateriſh, and the Bark of a much firmer Texture and hotter Taſte. The encreaſe of this Turnip Root in a ſhort Time is ſuch, that if it were not avouch'd by Perſons of good Credit and Reputation, it would ſeem incredible. The *Reverend and Learned Dr.* Deſaguliers, R. S. S. ſo famous for his intimate Knowledge in the *Experimental Philoſophy*, lately communicated to the *Royal Society* ſome wonderful Examples of this Nature, *viz. Turnip-Seed*, ſown *July* 2. 1702, appear'd above Ground in three Days. On *Auguſt* 12, a large Turnip, and probably not the biggeſt in the Ground, at the end of ſix Weeks weighed two Pound fourteen Ounces. There were 1000 Grains in an Ounce of the Seed. By his Calculation, one of theſe Seeds encreas'd 671600 Times its own Weight in ſix *Weeks* Time, 111933$\frac{1}{3}$ in one *Week*, 15990$\frac{1}{2}$ in one *Day*, 666$\frac{1}{4}$ in every *Hour*, and *eleven Times* its own Weight every *Minute* of an *Hour*. Another Turnip pluck'd up *October* 21, weigh'd 10 Pound and a half, which upon Calculation was found to weigh fifteen Times the Seeds Weight in every Minute, from the Sowing to the draw-

ing of it[a]. By this one may consider what a Torrent of Sap has flow'd in at this one Extremity of the Root, and what haste it made in the circulating, to remain within the Root it self, so as to form the *Parenchyma*, without ascending higher.

As this Plant is dispos'd to form the Root first, so there are other biennial Plants which first form the Leaves, and extend them to the full Length, before the Root has much encreas'd, *v. g.* In the Onion the Tubulous Leaves grow and encrease first, for the *Gardiners* usually trample them down towards the end of the Season, in order to dispose the *Onions* to grow. And here again the *Sap* has a distinct Circulation in the *Root*, beside that which is common both to *Root* and *Plant*; for each of the lateral *Squamæ*, of which the Bulb is compos'd, have their distinct *Tubuli*, discernible almost by the naked Eye, in which there is an Ascent and Descent of the Sap proper to the *Squama* it self, though I shall not deny but there may be an Intercourse of Fibers at the sessile Part, and that the Sap which ascends one *Squama* at one Time, may be receiv'd after its return, by the *Tubuli* of another *Squama*, and afterwards may ascend the Plant it self; by which we have still the more Reason to contemplate the wonderful Works of Almighty God, who so orders and dispose

[a] Philosoph. Transact. No. 360. p. 974.

of

of all Things, that there ſhould be an exact Symmetry in, and intimate Communication, Commerce, and Correſpondence among all the Parts of the ſeveral compounded Bodies throughout the World.

Nor is this diſtinct Circulation in the *Root* from the other Parts of the Plant peculiar to Plants alone. It is ſo in ſeveral Parts of the *Animal Body* alſo. In the *Heart*, the *Arteria Coronaria* makes a ſhort Tour throughout its *Parenchyma*, and ſoon returns by the Vein of that Name. In the *Abdomen*, the *Cœliack* and *Meſenterical Arteries* ſoon empty themſelves in the *Vena Porta*, the Blood in it is ſoon diſpatch'd to the *Liver*, from thence ſent immediately back by the *Vena Cava* to the *Heart*. The *Intercoſtal Arteries* in the *Thorax*, empty themſelves into the Veins of the ſame Name, which ſoon return the Blood towards the *Heart* by the *Vena Azygos*.

This extraordinary Admiſſion of nutritive Particles, is no more ſurprizing in the Roots below Ground, than it is ſometimes to annual Plants above Ground; for in the Roots there is ſcarce any exhauſting of the Particles which paſs out to the common Air. Whereas in ſeveral Plants, what paſſes through the Pores may be reaſonably ſuppos'd to exceed that in Quantity which remains within the Veſſels, and circulates throughout the whole Plant, *v. g.* In Preſence of the Celebrated Dr. *Halley*, R. S. Secr. I took up a Plant of the *Flos*

Solis, which was nine Foot high, the Weight was nine Pound; the principal Stalk was five Inches in Circumference, and one of the Heads was seven Inches in Diameter. Upon removing the Earth we found the Root, consisting of a vast quantity of small Fibers, which was one Foot Diameter, from the Points of the Fibres on the one side, to those of the other. They had descended obliquely six Inches in the Ground. We could not make an exact Calculation of its daily encrease, because we could not be justly inform'd of the precise Time the Seed was planted; but by a modest Computation, Dr. *Halley* was of Opinion it might augment about one Ounce in a Day of its Weight. If so, then I have Reason to suppose it might receive at least $\frac{2}{3}$ more of Particles from the Earth, which had evaporated into the Air; and the Reason of my Conjecture is, that upon the 25th of the Month of *September*, about 9 a-Clock in the Morning, I took up in the same Garden where the *Sun-Flower* grew, a Plant of *Nicotiana* or *Tobacco*, in its full Vigour, when most of the Flowers had blown, and several of the *Capsulæ* were full of Seed. This Plant was also nine Foot high, its Weight six Pound and a quarter. Here the *Roots* were not so full of small Fibres, but upon the transplanting of it, the principal Root had been bended, and there had another sprung from it of the same Bigness, each of them were about the Big-

neſs of the Thumb; theſe took up a large Surface of the Earth, for there was three Foot betwixt the oppoſite Extremities of theſe larger Roots, beſide ſeveral others. I was inform'd it might have been five Months from its firſt ſowing, which is not ſo very ſudden an Augmentation, though the Seed being one of the ſmalleſt that can be thought of, to be perceptible; 'tis a prodigious Enlargement in the Bigneſs, for one of the largeſt Leaves was 21 Inches long. Being willing to have an Idea of what it might exhauſt in a Day, or whether it would live any Time out of the Ground, as the ſucculent Plants do, I took ſpecial care not to break any of the Fibers in taking up the Plant, I choſe a dusky Morning, when it neither rain'd, nor was it warm or dry Weather. I carefully plac'd it among ſeveral Plants where the Sun-Beams could not reach its *Root*. On the *Monday* following, being *September* 28, at the ſame Hour, finding the Leaves very much faded, I weighed it again, and found it loſt two Pound and a half in ſeventy two Hours, for its Weight was then three Pound three quarters. It might have been eaſy to calculate both the Quantity of the Sap admitted, its daily *Diſpendium*, and what remain'd had a Computation been made of its daily encreaſe as to its Bigneſs.

I only mention theſe, to ſhew there's an an inſenſible *Tranſpiration* in *Plants* as well as *Animals*; that the Pores of ſome *Plants* are

are more open, and others more shut, and that some *Plants* may have a more volatile Sap than others, which will be of use here after in explaining of some *Phænomena*. And I look upon such a Computation as this to be of moment, both for the better understanding of the *Vegetation*, and to direct how to place *Plants* in a convenient Soil; for the insensible Transpiration is more regular in Plants than in Animals: And if the *Staticks* enabled *Sanctorius* to make so just a Calculation of the Transpiration in humane Bodies, and which the *late Learned Dr.* James Keyl so handsomely improv'd here in *Britain*, certainly if any would be at the Pains, they might be of moment if the Experiment were try'd carefully in *Plants* too, not by confining them to a Pot, as is usually done, but by sowing the Seed in a convenient Soil, considering the Time it lay under Ground, its daily Encrease after the Plant appear'd above Ground, both as to the lengthening of the Stalk, the daily Augmentation and Number of the Leaves and Branches, and every now and then taking up a Plant of such a Bigness, of the same Species and the same Soil, and weighing it, and letting it have all the Freedom of well-prepar'd and deep Earth, Air, Water, Heat, Damps, Dews and Sun-shine. By this one may come to know, not only the daily Proportion of the Plant in its Bigness and Weight, but also its proper soil, by trying several

veral of them in different Soils, and have an Idea of the Prevalency of their Virtues, by considering the Place in which they grew, which though little thought of, is much wanted. This is a much more natural way than that of weighing the Earth in a Pot, measuring the Water, *&c.* for by so doing it is impossible to know the natural Growth and Encrease of a Plant, *v. g.* The *Sun-Flower* which amounted to nine Pound Weight, did only occupy one Foot Diameter of the Surface of the Earth. *Nicotania*, which weighed six Pound and a quarter, spread forth its Roots so far that the opposite Extremities of some of them were at three Foot Distance. At this rate a *Sun-Flower* may chance to grow in a Pot and acquire its natural Bigness, provided it have depth enough of suitable Earth, whereas the *Nicotiana* would be so confin'd within a Pot of the same Bigness with that of the *Sun-Flower*, that we cannot suppose it would be so large, nor grow so high. And in this case too it were not inconvenient to take two Plants of each, of the same Weight and Bigness, from the same Seed-Bed; plant the one so as it may grow at its full Freedom in the Earth; and let the other be plac'd in a due Proportion of Earth, in a Pot, by which it may be observ'd which has the Advantage in the Encrease and Weight; for I am of Opinion, nothing that is constrain'd or forc'd can let us have any true Idea of the Vegetation of Plants.

I thought fit to propose these Methods of trying Experiments to the Curious, not having an Opportunity to do it my self, because there may be a juster Calculation of the Vegetation by the *Staticks* in *Plants*, than in *Animals*.

For in *Animals* there are to be considered the *Res Naturales*, as the *Cibus*, *Potus*, *Excrementa*, *Retenta*, *Quies*, *Motus*, *Animi Pathemata*. The *Cibus*, *Potus*, are to be considered both as to the Quantity, which is easy to be done by weighing; but then the Quality may alter, *v. g.* The Meat may be more or less solid, and more or less easy to digest. The Drink may be more or less spirituous, by all which the Perspiration may be more or less promoted; for the *Excrementa*, the *Fæces Alvi*, the *Urine*, and *Saliva* must be justly calculated, in order to make a Computation of the Perspiration; for the *Quies*, the *Sleep* and Rest of all the Blood and Humours which then move pleasantly, the Quantity perspir'd at such and such a Time, may be more easily computed; but then is to be considered the Time of going to Rest, whether after a full or empty Stomach, whether after a *Crapula* too much Liquor, or after having moderately *drank*; whether a Fatigue, or *moderate Exercise*; whether after the Person has *sweated* by abundance of Bed Cloaths, or if he has lain cool; and lastly, the *Passions* and *Affections* of the *Mind*, such as violent Transports by passionate Wrath and Anger, serious Reading and Thinking,

Thinking, which alſo exhauſts the Spirits; exceſs of *Joy* and *Gladneſs*, and *Deepneſs* of *Melancholy*, *Grief* and *Sorrow*. All theſe, I ſay, may make the Tranſpiration in our Body variable, according to Circumſtances and different Exigencies in a humane Life. But for Plants, if they are plac'd in a convenient Soil, and live in a ſuitable Seaſon, it is more eaſy to calculate their Perſpiration, for it is always in Proportion to the ſame Bigneſs in Plants of the ſame Species, the only Difference depending upon the Weather and Time of the Day, according to the different Preſſure of the Atmoſphere, and as the Pores are more open or ſhut; for as to Exerciſe, the Plants are always in a *Quies*, unleſs they be ſometimes more than ordinarily ſhak'd by the Wind. And as to their Nouriſhment, they always receive that in a due Proportion, according to the Goodneſs or Badneſs of the Soil. They have no Sickneſs of Stomach nor loathing of Appetite to deny their Food; no Fever, nor any other Diſtemper to diſenable them from receiving it, nor any excrementitious Secretion to exhauſt their Nouriſhment more than what is convenient; and therefore, as it is eaſy to conſider by the Surface of the Earth, and the Quantity of the Roots in it, how a Plant may encreaſe to ſuch a Bigneſs, in ſuch a Time, ſo we are able to make a Calculation of the Proportion in what the Plant tranſpires, with what it receives, but of this more hereafter.

I come next to consider the manner of Vegetation of the Trees, and so I shall compare the Motion of the Sap in Plants, with that of the Blood in Animals, and with Mr. *Bradley* compare the Tubes *which convey the Sap upwards to Arteries, and the Passages and Pipes by which the Sap retires downwards to the Veins.* 2. In Animals the Food is taken in at the Mouth, digested and prepar'd in the Stomach. The excrementitious Matter is separated from it in the Intestines. The Chyle or milky Juice, is from thence, by proper Vessels, convey'd to the Heart; from thence having paid a Visit to the Lungs, where by the Pressure of the Air it is the better prepar'd to undergo a future Circulation. After its return to the left Ventricle of the Heart, it is forcibly beat out thence, and compell'd to move towards the Extremities, where passing through all the minute and small *Capillaries*, it returns by the Veins to the Heart; and thus, by successive Circulation, the crude, chylous Particles are better digested, the more gross farther attenuated, and all the Mass of Blood is enabled to undergo the several *Vegetative* and Animal *Functions* requir'd by it. But in Plants there is no farther Preparation than a mere Reception of the Particles by the Pores in the Extremities of the *Radicle Fibres*. They are first set in Motion by the Heat, and forced up by a continual Succession of those that follow, till they arrive at the Extremities; from

from whence they return by the venal Ducts; ſo that whether in a Vapour or a Liquor, if one Particle be receiv'd into the moſt minute Pore or Fiber, and the other to which the ſame degree of Motion is conciliated, follow it as it were cloſe at the Heels, there being no mean of ſtepping aſide, the one muſt of neceſſity preſs the other upwards; and when they are arriv'd at the Extremities, as we cannot ſuppoſe all the Particles muſt either paſs out at the Pores in the Perſpiration, or be impacted betwixt the ſolid Particles already in a *Quies*, thereby to contribute to the Growth and Encreaſe of the Plant; ſo ſome of it muſt return of Courſe; and if this be granted, as it ſeems to me undeniable, what ſhould hinder a continual, uninterrupted Succeſſion of Particles, and Circulation of the Sap, of which they are compos'd, throughout all the Seaſons of the Year, as well in Herbs as Trees, without either being ſtop'd or condens'd in the Winter, or rendred more fluid in Summer, as ſome have imagin'd? But of this more hereafter.

The next thing to be conſider'd is, how theſe ſo very different Subſtances ſhall be form'd, from Particles proceeding from one and the ſame Earth, and in one and the ſame Tree. As Bread and Water can ſuſtain the vegetative Life of a Man, though perhaps ſuch a way of living may not prove ſo comfortable to him; and as Hay and Oats, or perhaps Oat-Straw, and the Oats themſelves, both being the Product

of

of the ſame Plant, can nouriſh a Horſe; and as from ſuch ſeeming homogenious Subſtances, the ſeveral diſſimular Parts of the Body, as they are called, ſuch as *Skin*, *Fleſh*, *Bones*, *Cartilages*, *Membranes*, *Blood-Veſſels*, *Nerves*, &c. can be form'd, ſo we may conceive the *Bark*, *Wood*, *Pith*, *Leaves*, *Flowers*, *Fruit*, *Seed* in *Plants*, may be form'd after the ſame manner; and although there be not ſuch various Preparations of the Sap in the one, as of the Food in the other, yet by the bare and ſimple Aſcent, Deſcent, and conſequently Circulation of the Sap, it can as eaſily form thoſe diſſimular Parts from the ſame Earth, and in the ſame Plant; for the Reaſon of theſe various Preparations of the *Aliments* in *Animals*, is becauſe the whole Subſtances are taken in at the Mouth, without any Diſtinction or Separation of one kind of Particles from the other, and that muſt be perform'd by the various Secretions, through the different Veſſels, whereas nothing enters the Body of a Plant, but ſuch and ſuch Particles as are fit to enter, or can be receiv'd into the Veſſels that paſs directly to the different Subſtances.

Thus in *Trees* the *Bark* is *analogous* to the *Skin* in *Animals*, the *Wood* to the *Bones*, and the *Pith* to the *Marrow*; for the Fibers of the *Muſcular* Fleſh, there is no need of that in Trees, for having no progreſſive Motion, they have no need of Muſcles, *which are the chief and immediate Inſtruments of ſponta-*

neous

neous Motion; and for *Glands*, the Alteration of the Direction of the Motion of the Sap (*i. e.* when the Duct of one *Tubulus* is diſcontinued, and the Sap in its Aſcent muſt from thence paſs into the Origine of another) and the Situation and Diſpoſition of one *Tubulus* in reſpect of another, do's the ſame Office in a *Plant*, as they do in an *Animal*. Therefore, when the *Root* of a *Tree* puſhes out its *Fibers*, theſe Fibers are the Continuation and an Elongation of the ſame Subſtances of which the Root it ſelf conſiſts. If then this Root is woody, covered over with a Bark, the Fiber muſt be ſo too. If the Pores and *Tubuli* of the Wood and Bark be diſtinct in the Root, ſo they muſt be in the Fiber puſh'd from the Root alſo. As in the third Place, the Fiber is of the ſame Texture as to its Pores and conſtituent Particles throughout its whole Extent; it muſt be likewiſe ſo in the Extremity, and if nothing can enter theſe Pores at the Extremity, but the Particles of ſuch and ſuch a Configuration, then the Subſtances compos'd by theſe Particles muſt be of the ſame *Texture*, *Hardneſs* and *Conſiſtence*. Nor needs this be difficult to be comprehended, when we conſider how it fares with the Animal Body, where though the Blood and Humours be more fluid, the Means us'd to force them into their ſeveral Receſſes, by the various Motions of the *Animal*, are more powerful; and though the Orifices of the *Glands* by the Softneſs of their

Texture, are more variable, as to their Configuration, yet we see what a Distinction there is betwixt their several Humours, separated in the different *Glands* of the Body. The *Glandulæ Parotides*, and *Maxillares* for the *Saliva*. The *Glands* of the *OEsophagus* and *Stomach* to assist the *Digestion*. The *Glands* in the *Pancreas* and *Liver* to separate the *Succus Pancreaticus* and *Bile*, to assist at the Separation of the *Chyle*. The Pores or Orifices of the *Lacteal Vessels* in the *Intestines* to separate the *Chyle*. The *Glands* of the *Kidneys* for the *Urine*. The *Orifices* of the *Spermatick Vessels* for Secretion of the *Seminal* Particles to be convey'd to the *Testes* and *Epididymides* in Men, and *Ovaria* in *Women*. The *Glands* in the *Brain* for the Secretion of the more spirituous Particles there. The *Glandulæ Lacrymales* for the *Lacrymæ* and that *Humour*, which *bedews* and *moistens* the *Eye*. The *Glands* in the Joints for the *Articulations* of the *Bones*; and lastly, the Orifices which separate the *Succus Osseus* in them, from the Blood-Vessels dispers'd throughout the Bones. Add to these the excretory Ducts, by which the superfluous Particles from the Blood are separated, to be perspir'd, by the *insensible Transpiration*. Now, I say, if we consider how all these various Substances are separated in the several Parts of the Body from one and the same Liquor, why may we not also suppose, that the Pores of different

different Structures may admit of the Particles which are only of ſuch a Structure and Configuration, and fit for the compoſing of the different Subſtances in the ſame Tree from one and the ſame Earth.

Though all *Trees* are perennial as to their *Root*, *Trunk*, and *Branches*, yet they have that which is called their *annual* and *perennial* Surface. The *annual Surface* appears only in the *Spring* and *Summer-Seaſon*, when they are cloath'd with *Leaves* and deck'd with *Flowers*; and in the *Autumn*, when they are loaded with *Fruit*, and have perfected the Seed. When the Flowers are ſpent, the Fruit is drop'd, and the Seed is ripen'd, the Leaves laſt of all fade, decay, and are driven away. But there are others, where, though the Flowers may appear in the *Spring*, or perhaps the *Autumn*, and the Fruit may ripen towards the *Autumn* or perhaps not till next Year, yet the Leaves never decay ſo as to leave the Tree altogether naked, but they gradually fall off as the new Leaves ſprout forth. Theſe are called *Evergreens*.

The perennial Subſtance, or Surface of Trees, properly ſpeaking, conſiſts of theſe three Parts, the Bark, Wood, and Marrow. I ſhall not here make any Diſtinction betwixt thoſe of the *Root* and the *Trunk*, only thus far as the Root has its proper Branches, by which the *Tree* receives the Sap uſually called its *Fibres*. So the *Branches* of the *Trunk*

not only partake of this Sap for its Support, but alſo diſperſe it throughout the *annual Surface* of Leaves, *&c.* whether the *Tree* be evergreen or not.

To give a clearer Idea of the Bark, I ſhall give an Abſtract of Dr. *Grew*'s Deſcription of it, ſo far as is fit for my Purpoſe. He ſays, *It conſiſts of two Parts, the outmoſt, or Skin, and the main Body. The Skin is compoſed in part of very ſmall Veſicles or Bladders cluſter'd together. As the Plant grows the Skin dries, and the Bladders diſappear. Among theſe Veſicles there are intermix'd parallel, ligneous Fibers or Veſſels.* He makes a doubt whether theſe Fibers are Air-Veſſels or Sap-Veſſels; but I have no Difficulty to determine the latter. *The main Body has its* Parenchyma, *compos'd of innumerable ſmall Bladders, cluſter'd together. Its Veſſels are diverſify'd many ways. They are of two different Poſitions and diſtinct Kinds as appears.* 1. *As to their Poſitions, they ſtand moſt numerouſly in or near the inner Margine of the Bark.* 2. *From the moſt apparent Diverſity of the Liquors or Saps they contain, which upon cutting the Branch tranſverſly do frequently bleed from them* [a]. I ſhall not trouble the Reader with enumerating his *Strata*, and their different Poſitions in the ſeveral Plants and Trees;

[a] Grew's *Anatomy of Plants*, Book iii. chap. 2. p. 110.

nor

nor ſhall I condeſcend upon the particular Uſe of the ſeveral Veſſels mention'd by him, ſuch as *Roriferous*, *Lymphatick*, *Reſiniferous*, *Lactiferous*, &c. Its ſufficient he divides the Bark into its *Veſicular* (which he calls its *Parenchyma*) and *Vaſcular* Subſtance, and that theſe Veſſels are ſo ſituated, as to convey two diſtinct Kinds of Sap. From hence its eaſy to conclude, that which he calls the Skin, reſembles the *Cuticula* in an humane *Fœtus* which when new born, is thicker in reſpect of the Skin or *Cutis*, than ever it is thereafter; for the Blood-Veſſels in the *Cuticula* have been injected as well as the *Cutis* in a *Fœtus*, which is not eaſy to be done afterwards. As that part of the *Cutis* next to the *Cuticula*, is called the *Tunica Papillaris*, becauſe endow'd with thoſe *Papillæ* or ſmall Veſicles which receive and retain the Particles ſeparated from the Blood, until they be evaporated by the Tranſpiration, all which *Papillæ* terminate in the *Cuticula*; of which I had an excellent Opportunity to obſerve, at the Diſſection of the Elephant at *Dundee*, *Anno* 1706 (*as in the Philoſoph. Tranſact*, *No.* 226, 227.) So in the Bark of Trees, that Veſicular Subſtance, both in that which we call the *Cutis*, and the *Parenchyma* of the Bark, may very well be ſuppos'd to be certain Receptacles of the ſuperfluous Sap, which flowing out from the parallel *Tubuli*, are from thence convey'd out to be evacuated in the common Air. 3. This

Diverſity of the Poſition of the Veſſels, and the different Kinds of Liquors which he ſays bleed from them, plainly ſhews them to be the Arterial and Venal Ducts formerly mentioned; and here again the Parallel holds, *for theſe Veſſels, which* he ſays *are diverſified many Ways*, reſemble very well the *Tunica Reticularis* in the Skin of Animals; for though there be no Neceſſity of ſuch a Contexture in the common Teguments of Trees, as in the Membranes of Animal Bodies, ſuch as the *obliquely aſcendent*, *deſcendent*, and *tranſverſe* or *circular Fibers*, by which they are capable of performing the ſeveral Motions requir'd, ſince there is no kind of Motion inherent in Plants; yet ſuch a Diverſity of Fibers, by which they become *reticular* or *interwoven*, ſeems requiſite in them too, eſpecially in the Bark, whoſe looſe Contexture might make the Fibers were they always Parallel, liable upon every ſlight Occaſion to be diſtorted. Whereas by this *Contortio Fibrarum*, by their being ſo wreath'd and interwoven, the Parallel Fibers of the different *Strata* annually added, are kept firm in their Place, and there is ſufficient Space between theſe various Interſections, for the Veſicular and horizontal *Tubuli* to convey the ſuperfluous Sap outward: So that the difference betwixt the Bark and Wood, conſiſts only in the looſeneſs of the Texture, and intermediate, excretory Ducts and Veſſels, by which

which the Sap tranſpires in the one, and the Compactneſs of the parallel Fibers in the other.

The *Bark* has its Veſſels either proper for its own peculiar Nouriſhment, or common for the Nouriſhment of the annual Surface. This is analogous to what is to be obſerved in the *Animal Bodies*, for the *Heart*, *Lungs*, *Liver*, and all the other *Viſcera Abdominis*, have much more Blood circulating through their ſeveral Subſtances, than is requiſite for the Support of the vegetable Life, beſide what is beſtow'd upon the *Muſcles* and *Brain*, for the better Performance of the Animal Motions and Secretions. And had this *Analogy* been hitherto duly conſider'd, Perſons of good Senſe would not have been at ſuch a loſs how to do with the Sap in the Winter Seaſon, when the *Animal Surface* has drop'd off; for 'tis eaſy to conceive how that ſame Sap which formerly puſh'd forth the Leaves, Flowers and Fruit, may now be employ'd either in encreaſing of the Bark and Wood, or by frequent Circulations be better attenuated and prepar'd for putting forth a new annual Surface in the enſuing Seaſon.

By what is ſaid 'tis eaſy to have an Idea of the Structure of the Wood, and to ſuppoſe, that the manner of its Augmentation is by the annual Addition of ſeveral *Strata* of parallel, *cavous Tubuli*, for the aſcent and deſcent of the Sap. That the lengthening or

heightening of the Tree depends upon the *Vernal* and *Autumnal Shoots*, and that the Addition of the *Strata* of the *Tubuli*, by which it encreases as to its Grosness, is perform'd during the Summer and Winter Solstices, so that there is Business enough to continue the Sap in a perpetual Motion throughout the whole Year, and no Occasion for its Stagnation or stopping at any Time.

For the better understanding of this, we may look upon the Fibers of the Root to be so many Pipes, like those of an Organ, obliquely or perpendicularly plac'd, and parallel to each other, whose Orifices are differently configurated for the Reception of such Particles as can be conveniently admitted into them, so that some enter those which compose the Bark, and others such as make up the Wood. That these Particles ascend, being press'd upwards by such as follow, and for the Augmentation and Encrease of different Substances. And for such as are superfluous, they either flow out by the Bark, are deposited into the Cavity where the Pith is lodg'd, or return by the venal *Tubuli* to the Root again, and so continue to circulate.

That the Pith is nothing but a *Depositum* of these superfluous or excrementitious Particles incapable to continue in *Area Circulationis* seems to be evident from Dr. *Grew*'s Observations, *viz.* That as the Bark and Wood grow thicker every Year, the Pith grows more slender,

ſlender, and that it is only moiſt for the firſt Year, and dry always thereafter. And Mr. *Bradley*, who ſays "'tis made up of little "tranſparent *Globules*, like Bubbles which "compoſe the Froth of any Liquor: For we may ſuppoſe that the Pores of the Root of the young Tree or Shoot, proceeding from the extended *Oculus* or Bud, are at firſt very open, that the groſſer Particles which compoſe the Pith, not being ſo ſubtile as thoſe whereof the ligneous and cortical Fibers are compos'd, are thrown aſide towards the Center; and make up a ſoft Subſtance, which by being looſe and incoherent, eaſily yields and gives way to the additional *Strata* of the *Ligneous Fibers*. But this Pith is very uſeful at the beginning, by keeping the young and tender Twigs ſo flexible that they bend and yield to every Blaſt of Wind. Whereas were they firm and hard (which they would be without this Pith) they would be ready to break; and in this they are analogous to Bones, which were it not for the Marrow, would be eaſily fractured by a very ſlight Accident.

The annual Surface of the Tree comes next to be conſidered. As the Seed contains the *Primum Principium* of the whole Plant, ſo the *Buds* contain the firſt Lineaments of the ſeveral Parts belonging to the *annual Surface*. They are three-fold: 1. The *Oculus*, *Gemma*, or *Bud* for the *Wood*. 2. For the *Flower*; and 3. For the *Leaf*. Theſe for the *Wood* are

are usually at the Extremity, and sometimes at the Sides of the last Year's Shoot, especially at its lower part, when they with the Leaves are alternately plac'd; for when they are situated by Intervals, or in Pairs, then the *Oculi* for the Wood are always at the Extremity, where they as it were padlock the Shoot, so that it can be stretch'd to no greater Length. When the Shoot is strong in a good Soil, sometimes two or more of these *Wood-Buds* will be put forth, and sometimes the Bud for the Leaf will become a Bud for the Wood, as Mr. *Fairchild* observes. These for the Flower are mostly at the lower part of either the last, or the Shoot of the Year before that. For Gardiners observe, that generally speaking, they are two Years in forming. These for the Leaf do proceed *è Foliorum Alis*, at the Root of the Pedicle for the Leaf of the last Year. After the Winter Solstice is over, when the Sun begins to return towards our Horizon, the Particles of the Earth ascend more freely, the common *Tubuli* in the Bark begin to be dilated, and the several *Gemmæ* by degrees are expanded and spread forth.

As the *Stolones* or *Shoots* are added every Year, so they always remain, unless they be accidentally or designedly remov'd before the Tree is fell'd. Some Trees only put forth one Shoot in a Summer-Season, as the *Peach-Tree*, *&c.* but the generality of them put

forth two, the *Vernal* and the *Autumnal*; the *Vernal* is lengthened from the beginning of the Expanſion of the Bud in *January*, to about the latter end of *May*, or beginning of *June*, when it ceaſes. This is call'd the ſetting Time, and is more late or early, according to the Soil or Seaſon. Every Shoot partakes of three different Subſtances, the Bark, which is very thin, one *Stratum* of Ligneous Fibers; and the Pith, which in ſome ſuch as the Elder or *Sambucus*, makes up the greateſt part. When the Shoot is fully ſet, there are a few more *Strata* added to the Ligneous Fibers, the Bark is proportionally thickened, but the Capacity of the Pith is leſſened; and now it is that the Fibers of the Root are alſo extended; for no ſooner do the Shoots ceaſe to lengthen, than the Fibers of the Root are ſtretch'd forth. Now it is alſo, that the ſeveral Buds for the enſuing Year begin to be form'd. In the Month of *July* Preparation is made for the ſecond Spring. This ſtretching forth of the Fibers of the Root in the Summer, has hitherto been but little obſerved, though I am credibly inform'd by that accurate and expert Gardiner Mr. *Thomas Fairchild* at *Hoxton*, that a Tree may be as ſafely tranſplanted during the Summer as the Winter Solſtice, provided due care be taken to keep the Root from being too much expos'd to the Air, and dry'd too ſoon. About the beginning of *July* the Buds for the autumnal

tumnal Shoot begin to be ſtretch'd forth, and the other Buds of the Vernal Shoot are fully form'd and ſtrengthened. Now again the Root ceaſes to ſtretch forth its Fibers, the Autumnal Shoot is lengthen'd, the Fruit and Seed is ripen'd, and ſcarce any Proviſion is made for ſtrengthening of the Bark and Wood before the latter end of *September*, when the Fruit is ſhaken off, and the Leaves begin to drop; and henceforward, until the Spring, the two Shoots of the preceding Seaſon are ſtrengthened, the Bark and Wood more plentifully nouriſh'd, and the Root ſends forth a new Supply of Fibers. And why ſhould this decay of the Annual Surface in Plants ſeem ſo ſtrange to ſome, that they muſt needs attribute it to the return of the Sap to the Root, as if it were not to be obſerv'd in Animals alſo, as one of the Conſequences of their Vegetative Life. Moſt of the *ſquamous Fiſh* throw their *Scales* every Year; for in ſome Seaſons they ſhall be catch'd very rough, and at other Times with very ſmooth *Scales*. The Reptiles, ſuch as *Serpents*, throw their Skin, called upon that account their *Exuviæ*, moſt Birds throw their *Feathers*, and moſt Quadrupeds their Hair. The Hart and Roebuck throw their Horns; and who will be at Pains to obſerve it, the Hair in a Man or Woman's Head do's not continue above two Years, and ſcarce ſo long, eſpecially if the Perſon is young; and

I hope none will ſay becauſe of that, that the Circulation of the Blood is ſtop'd.

The *Leaves*, which as I ſaid, ariſe alternately or in Pairs, are ſo obvious, that I need give no particular Deſcription of them, but I may enquire into their Uſe. Their being Ornamental, or a Shade to the Fruit, is not all, though it is very agreeable to ſee a Tree cloath'd with Leaves; and when they are eat up by Caterpillars, or blaſted and burnt up by Lightening, the Fruit either aborts; or if it chance to ripen, it is ſtill dry and unſavoury: Yet they ſeem to be deſign'd for a more ſpecial Uſe, and to contribute more for the vegetable OEconomy of the Plant than has hitherto been imagin'd, which is for the better Attenuation of the Sap, as is obſerv'd *Page* 350, when by frequent Circulations it is not only render'd more fit for the Formation of the Fruit and Seed, but alſo to be adapted to the Subſtances of the Wood and Bark in the Winter-Seaſon, when the *Tubuli* and Pores are more contracted, and where the groſſer Particles cannot ſo conveniently enter. If we conſider the ſpecial Care to ſeparate the Spermatick Particles by the various Turnings and Windings in the *Teſtes*, and that prodigious Number of moſt minute Glands in the cortical Part of the Brain, for the Secretion of the moſt ſubtile Particles of the Blood there, this Uſe for the Leaves may be the more eaſily comprehended. This is farther il-

luſtrated

lustrated, *page* 248, &c. *Essay* 4. when treating of the Preparation of the Sap for the Male-*Farina* in the Flowers, and Female Seed in the Fruit of Plants; and *Page* 342, when speaking of the *Poppy*: To which I need add no more, but that though the Flowers are form'd in Buds of one or two Years old in most Trees and Shrubs; yet the Vine produces them from the Vernal, and sometimes from the Autumnal Shoots of the same Year, as it was to be observ'd this Season in *the Physick Garden* in *Chelsea*, and Mr. *Fairchild*'s at *Hoxton*, when it produc'd ripe Grapes at *Michaelmas*. The Buds upon the former Years Shoots are fully form'd in the *July* preceding, where may be plainly descry'd the Clusters of the Buds of *Flowers* within one *common Blossom*. Its natural to suppose the Buds may be form'd, and bear upon Shoots of the same Year in them, because where they have Vineyards, they cut down the Vine yearly to the Ground; for the Sap circulating throughout the whole Plant in the Winter-Season, would weaken the Root too much. The Pores in the Extremity of the Fibers of its Root, are so wide, and the *Tubuli* proceeding from them so large, that by applying a Glass Tube to one of the Branches transversly cut in the Spring, so adapted that none of the Sap can flow down from the Stump and be spilt, it will visibly ascend or descend in the Day-time, according to the degree of Heat, as if it were a Weather-Glass. This reciprocal

Motion

Motion of the Sap, ſometimes more to the Root, at other Times more towards the top; now to the Annual, then to the Perennial Surface of the Tree, is rather a Confirmation than a Contradiction to the Opinion of its continual Circulation, which by what I have ſaid may ſeem to be undeniably prov'd; but for the farther illuſtrating of it, I ſhall take under Conſideration the ſeveral Kinds of Graftings.

1. That by the *Slip*, which is perform'd in the Months of *February*, *March*, or *April*, when the Shoot cements and incorporates with the Stock, the Sap firſt flows out at the incis'd Stump, and forms a *Callus* until it has forc'd its way into the *Tubuli* of the Shoot; after which it flows no more out at the Stump, but aſcends and deſcends betwixt the Stock and Graft as formerly when the Stock was entire.

2. By *Inoculation* this is perform'd in the latter end of *June* or beginning of *July*, according to the *Setting-Time*. I refer the manner of doing it to expert Gardiners, whoſe Buſineſs it is. The inoculating of a *ſtrip'd Bud* into a plain Stock, and the Conſequence that the Stripe or Variegation ſhall be ſeen in a few Years after, over all the Shrub above and below the Graft, is a full Demonſtration of this Circulation of the Sap. This was firſt obſerv'd by Mr. *Wats* at *Kenſington*, about 18 Years ago: Mr. *Fairchild* perform'd it 9 Years ago; Mr. *Bradly* ſays he obſerv'd

it

it ſeveral Years ſince; though Mr. *Lawrence* would inſinuate as if he had firſt diſcover'd it*. That Experiment perform'd in a *Jeſſamine*, is now to be ſeen in Mr. *Fairchild's* Garden. In *July* 1717, having a plain *Jeſſamine*, which mounted pretty high upon the Wall, being an old Shrub with two large Trunks ariſing from the Root, at one Foot Diſtance, where both were covered with Earth. He inoculated a ſtrip'd Bud in one of the Stocks, which was four Foot high. *Laſt* Year it put forth ſeveral Shoots very elegantly ſtrip'd; and this Seaſon ſeveral Stripes and Variegations appear upon the other Trunk, which is above ſix Foot high. This not only proves an Aſcent and Deſcent of the Sap in the ſame Trunk, but alſo that it circulates throughout the whole Plant to a great diſtance; for modeſtly ſpeaking, there appear'd this Year Stripes upon Leaves no leſs than twelve Foot diſtant from the Place where it was engrafted.

The conſequence of theſe Graftings makes good my Aſſertion, *p.* 340. *That the difference of the ſeveral Compoſitions depends upon the ſeveral Configurations of the Pores, which only admit of Particles of ſuch and ſuch a Figure, and deny Entrance to any other; or if they do enter, they muſt be molded and faſhioned according to the frame of the Pore.* For here we ſee, that after a

* *Clergyman's Recreation, p.* 65.

Bud

Bud or Slip is inoculated or grafted in the Stock of another Tree, whatever paſſes the *Callus* (this cemented part) betwixt the Stock and Graft, partakes of the Nature of the Graft, and not of the Stock. Nay farther, that the Stock below ſhall, in proceſs of Time, be of the ſame Texture with the Graft above, but the Graft above never alters from what it was, before it was taken from the Mother-Tree; or if it do's 'tis to the better. This can proceed from nothing, but when the Particles aſcend from the Stock, that they cannot enter the *Tubuli* in the *Graft*, until they be fitted for its Orifice, *v. g.* Suppoſe a quadrangular Particle to aſcend oppoſite to a triangular Pore, being forc'd upwards, it muſt be depriv'd of ſome one of its Angles, that it may enter into the Pore which has only three Sides: and again, ſuppoſe a triangular Particle to aſcend directly towards a round Pore, all its Angles muſt be rub'd off before it can have Admittance: So that the Particles which proceed from the Subſtance of one Combination entring that of another, muſt be ſo framed as to coaleſce, and be united with that Subſtance into which it is entred, and rendred incapable of joining any more with the Subſtance from whence it came, and the new molded Particles augmenting in their Number as they return to the Stock in Proceſs of Time are capable to render the Subſtance of the Stock, homogenious with the Graft, but the

Graft never becomes homogenious with the Stock. Hence it is that the Fruit always partakes of the Nature of the Graft; that one Tree ſhall produce ſeveral Fruits of different Kinds, according to the ſeveral Grafts; that the Fruit from a Shoot grafted in another Stock, ſhall be more delicious and fine than that of the *Mother-Tree* from whence it was taken, becauſe the Particles have not now ſo eaſy an Admittance into its Pores as formerly, when nothing intercepted them in their Aſcent from the Root; but they muſt be farther attenuated before they can enter the proper Pore, which is not now ſo parallel to the *Tubulus* below as formerly; and 'tis by the Deſcent of the Particles from the Graft, and their Reaſcent, that the Variegations appear in the other parts of the Shrub: A pregnant Example of which happen'd to Mr. *Bridgman*, Gardiner at *Hertford*, who engrafting a *Hedge-hog Slip* into a *Holly*, the *Graft* dy'd, but another Variegation appear'd afterwards below it, upon the ſame Stock.

Circumciſion (as the *Gardiners* call it) is a third Argument of the Circulation of the Sap. Mr. *Fairchild* has in his Garden a *Wall-Pear-Tree* divided into three principal Branches. Three Years ago he cut off the Bark, round each of them (in the Month of *May* or ſhortly before the Setting-Time) in two Places, at about three Inches diſtant, and made the Wood very bare betwixt the Inciſions. In

the *September* following the Bark ſwell'd very much above the Inciſion. The Spring following they produc'd Fruit very pentifully, and ſo they have done every Year ſince: So long as the Bark remain'd diſunited, they never put forth any *Wood-Shoots*, but produc'd *Flower* and *Leaf-Buds* very plentifully; ſo that the Sap which was formerly beſtow'd upon the Shoots, is now ſpent upon the *Bearers*, as they are called, *i. e.* upon the *Flower-Buds*. Not long after, the cortical Fibers were extended, and the Bark join'd from above and below in that part of the two lateral Branches which is toward the Wall, ſince which they do not produce Fruit ſo plentifully; but they begin again to make for the encreaſe of the Tree, by putting forth *Wood-Shoots*. But the Bark in the *middle Branch* ſtill remaining diſunited, continues to fructify plentifully, ſends forth no *Wood-Shoots*; and as it begins to bloſſom more early in the Spring, ſo having drop'd its Leaves a Week before *Michaelmas*, the Leaves of the other two remain till paſt the middle of *October*. From the beginning of *September*, after ſetting of the *Autumnal Shoot*, the additional *Strata* of the Bark plainly appear by a new Tumefaction or Swelling at the upper part of the Inciſion. Below the Inciſion the Branch is only four Inches round. About the bare Wood, where 'tis depriv'd of the Bark, it is three Inches, and above the Inciſion it is ſix Inches. This Augmentation

in the Bigneſs of the Branch, clearly demonſtrates how the Sap, being interrupted in its Deſcent, immediately returns toward the top; that the Circulation is as well maintain'd from the incis'd part as from the Root, and that the annual Surface may, upon extraordinary Occaſions be as well nouriſh'd by the *ligneous* as *cortical Fibers*; for if (in this caſe) the Sap did not aſcend by the Wood, it would not return ſo plentifully by the Bark, eſpecially after ſo much is ſpent upon the Fruit and Leaves, beſide what flows out by the inſenſible Tranſpiration.

This Experiment alone is able to clear up the Debate, Whether the annual Surface is nouriſh'd by the Bark or the Wood; and along with the Obſervation of the *ſtript Jeſſamine*, to ſhew that the Bark and Wood have not two diſtinct, but one common Circulation: For if the tinctur'd Sap deſcended four Foot, paſs'd through the Root under Ground to another Stock which mounted ſix Foot, and has been ſeen upon the Leaves in ſeveral Branches of that Stock, perhaps at two or three Foot Diſtance; (to all which I have been an Eye-Witneſs) and if the ſame has been obſerv'd by others upon twenty different Plants of *Jeſſamine*, as Mr. *Bradly* affirms, that puts it paſt all doubt, that the Sap has as common and free a Circulation throughout the whole Body of Plants, as the Blood circulates in Animals. If 2. By bereaving the Trunk or Branch of a Tree of its

its Bark, it ſhall fructify more plentifully, not only the firſt Year, when it may be ſuppos'd the Sap already mounted above the incis'd part may do it; but for ever after, ſo long as this *Solutio Continui* remains of the Bark; and if its obſerv'd, that no ſooner do the cortical Fibers unite, than this plentiful Fructification ceaſes, and the Tree makes more to the Wood than to the Fruit as formerly, which it continues to do until another Inciſion is made after the ſame manner. This to me ſeems very evident, that though the Bark and Wood are two different Subſtances, yet there muſt be ſuch a Communication betwixt their *Tubuli* at the Extremities, as there is betwixt the Arteries and Veins in Animal Bodies, by which the Circulation is freely maintain'd. Therefore Mr. *Parent* his Examples of the *Elm-Tree*, which was depriv'd of its Bark from the Root to the Branches, and yet produc'd Leaves; of other four *Elms* in the *Garden* of *Luxemburgh*, that were ſtript quite naked from a little above the Ground, to pretty high in the Trunk (and one of the four which had no Bark left at all) yet liv'd four or five Years, and produc'd Flowers and Leaves; aud of the *Platanus* or *Maple-Tree*, that being depriv'd of its Bark, it was ſoon cloath'd with more, as the Serpent is with a new Skin, may well be credited. But I am not of his mind, that the *Pith* affords any Nouriſhment to the

" Plant, as he would pretend in the *Elder* " and *Vine* while they are young, and after- " ward by the *Ligneous Fibers* while they " are old. (Neither is it a Proof that the " whole Nouriſhment is deriv'd from the *Lig-* " *neous Fibers*, becauſe of the ſudden en- " creaſe of the Slip after Grafting *. But in my humble Opinion the Bark and the Wood are nouriſh'd by proper *Tubuli* belonging to each; the annual Surface is more peculiarly nouriſh'd by the *Tubuli* common both to the Bark and it; the *Pith* has no proper Veſſels for its Nouriſhment, but is only a *Depoſitum* of ſome certain Particles at the beginning, or during the Formation of the *Ligneous Fibers*, as has been obſerv'd, but upon any extraordinary Emergency there is ſuch a Communication betwixt them, that the one very readily ſupplies the Defect of the other, which may be farther confirm'd by the following Example.

Mr. *Fairchild* informs me, That if this Inciſion is made upon the Trunk a little above the Ground, before it has emitted any lateral Branches then it is ready to kill the Tree; but if it has ſent forth but one ſmall *Twig* of the Bigneſs of one's *Finger* or *Thumb*, that will ſave the Tree alive. The Reaſon is plain; for the *Root* being depriv'd of the return of

* *Hiſtoire del Academie Royal des Sciences, pour L'an.* 1711. *p.* 55. *Edit. Amſt.* 8vo.

the

the Sap by the Bark, all of a ſudden it periſhes, becauſe what deſcends by the *Ligneous Fibers* is not able to ſupport it; but when it receives a little by this ſmall *Twig*, and when the Sap, now diverted, flows more plentifully into it, this, by a more ſpeedy return is capable to maintain the Circulation betwixt the Root and it for ſome time, until the Sap flowing more plentifully and perpendicularly by the *Ligneous Fibers*, ſupplies the Defect of the Bark, and nouriſhes the *Annual Surface*, by opening a more free Communication at the top, betwixt the cortical and ligneous *Tubuli*, ſo that the Particles formerly employ'd in forming the *Wood-Shoots*, are now ſpent upon the *Leaves*, *Flower* and *Fruit*. Hence it is that the *Leaves* and *Flowers* bloſſom more early, the Fruit is more plentifully produc'd, becauſe nothing remains for lengthening and encreaſing of the Wood.

This Method of explaining the Nouriſhment, is, I hope, ſo convincing, that hereafter there ſhall remain no more doubt of the *Circulation* of the Sap. What now remains, is to enquire what is the *Materies* of this Nouriſhment, or whence it proceeds. The *Materies* is a *Congeries* of heterogenious Particles, ſo regulated and diſpos'd, as to be capable to enter the Pores of different Plants, according to their ſeveral Configurations. I have hitherto ſpoken of the Earth, as the Element endow'd with the greateſt quantity of theſe Par-

ticles; but if any of them are in the Water and Air, that do's not hinder their being admitted, ſo as to make up the *Compoſitum* of the Plant, provided they enter *Via Ordinaria*, as it may be call'd, by the Extremity of the *Radical Fibers*, as by the Mouth in *Animals*; for as no *Animal* can be nouriſh'd by what it receives into the Pores, no more can any Plant be nouriſh'd but by what it receives by the Extremity of its Fibers, whether it be by Slip or Root; nor can any Plant be nouriſh'd by *Air* or *Water*, otherwiſe than by ſuch Particles ſuſpended in theſe two, as are uſually contain'd in the Earth.

Dr. *Woodward* is in the right when he aſſerts, that the Water do's not nouriſh a Plant; but when he affirms, *That a great part of the Terreſtrial Matter that is mix'd with the Water, aſcends up into the Plant as well as the Water*[a], I cannot join with him. By *Terreſtrial Matter* muſt be meant a *Congeries* of the various Particles of which that groſs Subſtance call'd Earth, is uſually compos'd: That I am poſitive can never aſcend up into the Plant as well as the Water. But if we are to conceive ſome active Particles in this Terreſtrial Matter capable to be diluted, and being ſuſpended by the Water, fit to enter the Pore of the Plant, and to be convey'd into its moſt intimate Receſſes, by the Water,

[a] *Philoſoph. Tranſact. No.* 253. *page* 209.

which is a *Menſtruum* to it; that may be eaſily yielded to. And for the Water it ſelf, though it may be inſinuated into the *Tubuli*, diſtend and ſtretch forth the Veſſels, extend the length of the Plant, by interpoſing betwixt the Interſtices of the nutritive Particles, and conciliating a greater Space for them to move in, thereby encreaſe the Weight, and augment the Bulk of the Plant; yet it can no more be ſaid to nouriſh it, than a Man can be ſaid to be fed by drinking a prodigious quantity of Water, ſo as to diſtend his Stomach. *The Doctor* (ſuppoſing the common *Nitre* ſold in the Shops to be the ſame with the *Nitro-aerious* Particles, an Expreſſion which ſome have us'd for explaining the Vegetation, and the *Lixivial Salt* in the Aſhes of Wood, to be the ſame with the *Salino-ſulphureous*) *diſſolv'd, a Dram of* Nitre *in* Hyde-Park *Conduit Water, and put Mint among it in a Glaſs. In another Glaſs he diſſolv'd an Ounce of good Garden Mold, and a Dram of* Nitre; *in a third half an Ounce of Aſhes of Wood, and a Dram of* Nitre, by all which he obtain'd what was to be expected, *viz.* the ſudden Death of the Plant [a].

What has been ſaid of the Water, as being an *Element* by which Plants are nouriſhed, may alſo be ſaid of the *Air*, *viz.* That however it may ſuſpend a great Quantity of diſunited and dis-join'd, heterogenious Particles, which by their Groſsneſs and Incapacity of

[a] Ibid. 206.

being

being long ſuſpended, may fall down upon the Earth again, near any Plant, and by the Fluidity in the Earth it ſelf, or by the ſubſequent Rain, may be ſo far introduc'd into the Subſtance of this Earth, as being appoſite to, may be receiv'd by the Radical Fiber of the Plant. But I have no imaginable Idea how a Plant can be nouriſh'd by the Introduction of the aerial Particles through the Pores of its Surface above Ground. Therefore I am ready to aſſign another Uſe to thoſe Veſſels call'd *Tracheæ* by the Celebrated *Malpighi*, and the *Air-Veſſels* ſo frequently mention'd by the Learned Dr. *Grew*. Their too great Fondneſs of theſe *Tracheæ* or *Air-Veſſels*, having not only perverted their own penetrating Judgments, but alſo led others too obſequiouſly into their Opinions, without being at Pains to examine the Matter themſelves.

But if any ſhall duely conſider, That all Plants are nouriſh'd by the aſcent of Particles from the Earth, ſuppoſing they did not deſcend in a Circulation, but that the ſuperfluous Particles flow'd out as it has hitherto been believ'd, at the top, how can it be ſuppos'd that the aerial Particles can enter by theſe Pores, by which the other were tranſmitted? This would infer a quite contrary Courſe in one and the ſame Duct; which is contrary to all the Rules of Mechaniſm; for at this rate, either as *Theodorus Craanen* imagin'd, there muſt be two Kinds of Pores, *viz.* *Foris-intro*, and *Intro-foris*

foris Spectantes, or all the Pores in the Plant being directed the ſame Way, the *Tranſitus* of the Particles through them muſt have the ſame Courſe; and this muſt rather be an Efflux than an Influx. The great *Diſpendium* in *Nicotiana*, formerly mention'd, *viz.* That of ſix Pound and a quarter, it loſt two Pound and a half in three Days Time, is a full Proof of this; and as a further Evidence, another Plant of *Tobacco* of the ſame Soil, of four Pound and a quarter, has now remain'd a Week with Roots plac'd among Water; and it has rather encreaſed than diminiſh'd in its Weight, brisk and lively, enlarging Bloſſoms, *ſpreading Flowers*, and filling the *Seed*. I have already accounted how Water may be ſaid to augment a Plant, but not to nouriſh it; and the Reaſon why this ſecond *Tobacco Plant* ſtill continues to be the ſame, is very plain; becauſe a new Succeſſion of Particles from the Water aſcend, and ſucceed to thoſe which daily continue to avolate through the Pores of the Plant; nor need I have recourſe to any other Experiment than what uſually happens, *viz.* when a Plant is pull'd up by the Root, according to its Texture; firſt the Flowers, then the Leaves begin to corrugate and become wrinkly and crumbled, or wrap'd up, and afterward the whole Plant, *viz.* the Stalk and Bark, and laſt of all the Wood, decay and dry up. And whence can all this proceed, but from a *Diſpendium* of Particles through

through the Pores, and that Liquor formerly in the Veſſels, now evaporated in the common Air? From which I have the greateſt Reaſon to conclude, that all the Pores in the Plants are for the Emiſſion or Egreſs, and not for the Immiſſion or Ingreſs of Particles into the Plant. Nor is it any more difficult to explain by this Syſtem, how the Air ſhould become as beneficial to Plants as to Animals. 'Tis true, that Animals have real *Tracheæ*, the Wind-Pipe, or *Larynx* and *Lungs* into which the Air is admitted, and that without Inſpiration as well as Expiration, they cannot live; but it is now demonſtratively prov'd, that our Breathing is not in order to the Admiſſion of aerial Particles into the Blood it ſelf, but to render the Blood (formerly diſunited by the frequent Circulations in the Veſſels through which it had paſs'd) more firm, compact, and its Particles by the Preſſure of the Sides of the Veſſels more ſtrictly united and combin'd into *Globules*. But whereas in Animal Bodies, if by being too ſuddenly, or too much expos'd to the Air, the external Pores ſhall be ſhut and contracted ſo, that the daily Tranſpiration is hindered, if not quite ſtop'd, we feel a great Uneaſineſs over all our Body, and we are expos'd to various Diſtempers, ſuch as *Colds*, *Catarrhs*, *Coughs*, *Rheumatiſms*, *Diarrhœa's*, *Fevers*, *Agues*, *&c.* In a word, as there is ſcarce any Diſtemper incident to us in theſe cold Climates, but what may be more

or

or leſs ſuſpected to proceed from the Obſtruction of our Pores; ſo in Plants, the expoſing them more or leſs to the Air, the affording a more or leſs Degree of Heat to ſhut or open their Pores, may make them either live or die; make them brisk, lively, and to *ſprout*, *bud*, put forth their *Bloſſoms* and *Leaves*, or *droop*, look faded, and throw their Leaves; for if the Particles have got into the excretory Ducts in the Bark, heſitating there, it hinders the Excretion of any more from the *Tubuli*; theſe, by a continual Succeſſion of Particles from the Root, become too much diſtended, and the vegetative OEconomy is diſturb'd throughout the whole Plant. How much will a cold and frosty Blaſt of Wind kill the tender Buds in the Spring, and bereave the Gardiner of a plentiful Expectation of Fruit? ſo that he who hug'd himſelf the one Day by the glorious Appearance of *Bloſſoms*, one Night or two ſhall deprive him of all his Hopes, all theſe Bloſſoms being dry'd up, mortify'd, and depriv'd of the common Life with the Tree; and on the other Hand, an imprudent Management in the Stove, will, by too great a Heat, force up the Sap ſo precipitantly, and dilate the Pores ſo, that the leaſt ſupervenient Cold upon ſhutting of them, is ready to put the Plant in danger of its Life, if not kill it altogether.

This naturally leads me to the Conſideration of the *Succulent Plants*, of which ſo great

great a Variety has been tranſported to *Europe* within theſe Forty Years. *See Eſſay 3. p.* 204, 205. They are ſuppos'd to live by the Air, but they may rather be ſaid to live by Water. I confeſs, I have not hitherto ſo far examin'd their Structure, as to give ſo general an Idea of it as will ſuit with all their *Phænomena*: But upon the viewing a ſmall *Aloe* in *Mr.* Fairchild's *Garden*, which has a ſhort thick Leaf, cut off as it were in the middle, being thick, broad, and as it were quadrangular at the Extremity; I ſay, upon beholding its Structure 'tis no wiſe difficult to explain ſeveral of the *Phænomena* incident to its *Congeners*. Its external Coat conſiſts of parallel Fibers ſtrictly combin'd and cloſely united together, ſo that its Pores muſt be very minute and ſmall, with ſeveral pretty large longitudinal *Tubuli*, of different Magnitudes, but viſibly cavous, running up its back part, and turning obliquely downwards, when they come to the obliquely flat Extremity. Its inner Snbſtance is *Diaphanous* or *Tranſparent*, ſo that either the Sun-Beams, or the Candle-Light will ſhine through it for the Space of two Inches. This is a *Congeries* of moſt thin, fine, delicate, membranous Tunicles, interſecting each other, like the Caverns of an Honey-Comb. Theſe *Cellulæ* are full of Sap, ſcarcely communicating with one another, but by ſmall minute Pores; for if you cut one Series tranſverſly, it will be only emp-

ty'd,

ty'd, and no more will flow out. From this ocular Inſpection 'tis eaſy to explain all the Incidents of this Plant. 1. It can be nouriſhed by a very ſmall Quantity of Earth, becauſe it has no other *Parenchyma*, than its outer Membrane, and the Addition of a very few Particles will ſupport it a long Time. 2. Not being porous, nor being endow'd with ſo many Divarications into ſmall *Tubuli*, its Sap can neither be farther attenuated, nor will the minuteneſs of the Pores permit it to be evaporated; ſo that the *Celluls* can remain along time repleated with that ſerous and diaphanous Liquor, without being exhauſted; and after the Capacity of its Leaves is full, it may live as well ſuſpended in the Air as in the Earth. 3. It muſt be kept warm in a Stove all the Winter, to prevent its Sap from being congeal'd or frozen; for if this viſcid Liquor were once depriv'd of the inteſtine Motion of its Particles, they could never ſuſtain the Life any more. 4. When it's to be tranſplanted, or any new Shoot from it improv'd, it muſt be ſuſpended or lie a good time above Ground, until much of its Sap is evaporated; otherwiſe, when put into rich, new Ground, by the addition of too many nutritive Particles at once, 'twould be ready to be ſurfeited and choak'd.

Though the other *Succulent Plants* are not all of the ſame Subſtance, but ſome are more fibrous, others more cellulous, the Juice of ſome

ſome milky, others viſcid, and a third tranſparent and ſerous; yet they all agree in this, that their Juice is not ſo volatile as to evaporate ſpeedily; their Pores are extreamly ſmall, and external Fibers compact; that when their *Parenchyma* is once well form'd, and competently nouriſh'd, a very ſmall quantity of Earth will ſerve to do more, but rather a ſmall addition of Water is wanting to dilute the viſcid Juice, when perhaps the more tenuious Parts are evaporated, and the vaſt addition ſome of them receive in their Encreaſe and Weight, while in a ſmall quantity of Earth, muſt depend upon the neceſſary Supply of Water, which keep both their veſicular and vaſcular Subſtance repleated and diſtended; but if there be two great a quantity of Water furniſhed to them, they will be ready to rot and gangrene, from too great a Diſtention of their Fibers. Hence it is that ſome of the prickly Kind will diſtill clear Water at the Prickles, which cannot evaporate at the Pores; and without this Bleeding, as 'tis call'd, the Plant would be ready to periſh. This general Idea of them may ſerve until a more ſtrict and exact Scrutiny be made into their Structures; but by all this it plainly appears they are never fed by the Air. Dr. *Udal* at *Enfield*, has a great Variety of them in great Perfection, as has Mr. *Fairchild* already mention'd, who has been ſo kind as to favour me with the Delineation of a few of them in Copper-Plate, among

among whom is the little *Cuſhion-Aloes* now deſcrib'd. Nor is Dr. *Sherard* wanting to enrich this *Iſland* of *Britain* with a continual Supply of new Species from his Correſpondents Abroad.

I conclude with the Examination of the Principles upon which Mr. *Bradly* has founded the *Generation* and *Vegetation* of Plants, ſuch as *Suction*, *Attraction*, *Steam* and *Vapour*, *Condenſation* and *Stagnation*.

1. *Suction* and *Attraction*: *The Root havin ſuck'd in the Salts of the Earth*, *p.* 4.—— *Or by its magnetick Virtue*, *p.* 14. *By its attractive Quality*, *p.* 19. All theſe are reciprocal Terms, which differently expreſs the ſame Thing, for *Sucking* is only a *Drawing*. Where-ever they obtain the *Vis Impellens* and the *Vis Attrahens*; the *impellent* or *ſucking*, and *attractive drawing Power*, muſt be of greater force than the *impell'd*, *drawn* or *attracted Subject*. 2. There muſt be a *Cauſa Efficiens* for the *Motus* of the *Res à quo* to the *Res ad quem*. In Pumping, the *Leather* and the *Manubrium*, *Handle* and *Chain*, to which the *Pump-Box* and *Leather* is fix'd, are ſet in Motion by a Perſons Hands, or ſome other *Engine*. In *Sucking* and *Drinking* the Motion of the *Muſcles* for *Inſpiration*, and of the *Cheeks*, are the *Impellents* of the *Liquor*. In *Attraction*, the Power of the *Magnes* muſt be greater than that of the Steel which it attracts.

I do not here pretend to explain how this *Attraction* and *Suction* is perform'd, that being extrinsick to my Design; but from hence I infer, 1. Though the Root be of greater Force than the Particles said to be suck'd into it, yet it can never have the *Vis Impellens*, because it wants the *Causa Efficiens*, therefore the nutritive Particles can only enter the Extremities of the Root in their accidental Ascent; and if they were not thus intercepted by the Pore ready to receive them, they would evaporate into the common Air. Nor, 2. Can it be *imbibing* as a *Spunge*, for the Roots of Plants are so far from being *spungy*, as Dr. *Grew* imagines, that they are as solid, or rather more solid, and cloath'd generally with a thicker Bark, than any part of the Plant. 3. The subtile Particles from the *Farina* can never draw the gross, nutritive Particles to the *Seed* in the *Seed-Vessel*, with greater Force than the Motion already conciliated to them by the subterraneous Heat; but the effect of these Particles from the *Farina*, must be produc'd by Penetration. See *Essay* 4. p. 277. a pregnant Example of this Penetration is as follows: Take a Solution of *Vitriol*, and write with it upon *Paper*, the Writing will immediately disappear and become invisible; write above it upon the same Paper with Ink made of *burnt Cork*, which will be visible; place this Writing next the Cover in one side of a Book,

and

and place exactly oppoſite to it, in the other ſide of the Book (ſuppoſe it to be a pretty thick *Quarto*) ſome *Cotton* dip'd in a Solution of *Calx Viva*, or *quick Lime*, and *Auripigmentum*; ſhut the Book cloſe, and put it into a Preſs, and in a few Minutes the viſible Ink ſhall diſappear, and the inviſible Ink will appear. This I have ſeen often done. Now if ſuch a Penetration can be perform'd through a pretty thick Book, why may we not ſuppoſe ſubtile Particles may flow from the *Farina* in one part of the Flower, or from a Neighbouring Flower in the ſame Plant or *Species*, and penetrate the *Seed-Veſſels* and *Seed*, eſpecially ſince they have the ſame Configuration of Particles and Pores.

Steam, Vapour and *Condenſation. Made to evaporate in a Steam, as the Matter in a Still——When the Vapour arrives at the extream Parts of the* Buds *of a Tree, it meets with* Cold *to condenſe it into a Liquor*, p. 4. Where there is a Steam or Vapour, there muſt be a large, capacious Cavity, in which the diſunited and rarify'd Particles, may move freely; for if they are confin'd within a ſmall Space or Bounds they muſt be ſtrictly united, which is called *Condenſation*, and then they appear *ſub forma Liquoris*. And what a vaſt large Root muſt the *Vine* or *Birch-Tree* have, if this be the Caſe to contain the *Steam* and *Vapour* of ſuch abundance of Liquor as flows upward from it in the Spring, or the Root of

a *Pompkin*, which nouriſhes ſuch large Fruit from ſo ſmall a *Seed* in one Seaſon. It were more reaſonable to ſuppoſe, that the Blood in Animals were at firſt only a *Steam* and *Vapour*, becauſe of the intrinſick Heat capable to rarify its Particles, occaſion'd by the ſeveral ordinary and extraordinary Animal Motions; but we ſee the contrary, and that the Blood *ſub forma Sanguinis* is contain'd in the *Tubuli* of the *Capillaries*, and at the Extremity of the Body, very near as minute as thoſe of Plants: For it's from the Blood contain'd in the *Muſcular Fibers*, that they are tinctured with the red Colour, otherwiſe they would be as white as the *tendinous Fibers*, of which they are only the Elongations more looſely combin'd; and in how ſmall Cavities the Blood is contain'd, may be ſuppos'd, when 1. By the Puncture of a Pin in the Skin, or any muſcular part of the Body, the Blood ſhall flow out. 2. By the quantity of Blood in a humane Body, it being by a modeſt Computation about twenty five Pound, and yet the largeſt Veſſel ſhall not be much above $\frac{1}{3}$ of an Inch Diameter; ſo that there muſt be a prodigious Number of Branchings and Divarications to contain the whole. 3. From the Injections of ſeveral accurate and expert Anatomiſts of this laſt and preſent Age into the moſt minute *Capillaries*, ſuch as the late famous Dr. *Nuyk* and *Ryſch* perform'd, and of which *Mr. St. Andre*,

Andre in *Northumberland Street* lately ſhew'd ſome curious Preparations to the *Royal-Society*.

I ſay, if all theſe ſhew that the Blood is never *ſub forma Vaporis* in the Animal Bodies, where the natural Heat would be more ready to turn it into Steams, we can never ſuppoſe ſuch *Steam* or *Vapours* to be in the Bodies of Plants, which are only endow'd with, as it were, a borrowed Heat, to ſet its nutritive Particles in Motion; but its more reaſonable to think, that after one Particle has entred into the Pore of a Root, another may follow in that ſame Paſſage in a direct Line, and ſtill more ſucceeding, the one preſſes up the other; that ſeveral of theſe minute *Tubuli* may be conjoin'd ſo as to form larger Trunks, and although the *Succiferous* Veſſels are not to be ſeen ſo large in Plants as the Blood-Veſſels in Animals, becauſe the quick Motion of the one is not ſo requiſite as the other (for the heterogeneous Particles of the Blood muſt circulate more frequently, to be farther attenuated and prepar'd; whereas the nutritive Particles in Plants are prepar'd by their very entring into the Pore, otherwiſe they could not be receiv'd) yet there is the ſame Reaſon for the *nutritive Particles* of *Plants* to be *condenſed* into a *Liquor* at firſt, as the *Blood* in *Animals*. And I cannot underſtand, 2. How the Buds of Plants can be form'd by the Vapours being *condens'd and thicken'd into a Water when*

they feel the Cold, *p.* 5. At that rate the *Buds* would be beſt form'd at *Chriſtmas*, ſooneſt come to bloſſom, and be moſt readily blown in the *coldeſt Spring*, which is quite the reverſe from what really happens; for it's in the Heat of the *Month* of *July* that they are form'd, and it's by the *warmeſt Spring* that they are cheriſh'd and the moſt early *blown* and brought to Perfection.

Stagnation. The Sap is thicken'd or condens'd by the Winter's Cold, and is thereby chang'd into the Conſiſtency of Gum; and being thus ſtagnated, cannot move any more until the following Spring, p. 7. That *the Warmth, or ſome artificial Heat rarifies it into its former liquid State.* No *Liquor* in *Area Circulationis*, can *ſtagnate* without the Succeſſion and Accumulation of the ſubſequent, circulating Particles, which muſt be the cauſe of a preternatural Dilatation of the Veſſels, from whence a *Tumour*, (as in the obſtructed *Glands* in the *Animal Bodies*) ſuch as *Scrophulous Tumours*, *Steatoma's*, *Sarcoma's*, *&c.* muſt be generated. And 2. No circulating Liquor can thicken, unleſs it is by the *Evaporation* of the more ſubtile, and the *Precipitation* and ſubſiding of the more groſs Particles, the *Serum* which remains not being able to ſuſpend them any more; and if the more intimate Union of this circulating Liquor is thus diſſolv'd, no means whatever can make it to circulate aright again; and if that cannot be obtain'd,

obtain'd, it muſt become vapid, turn acid and acrimonious, as the Blood in the obſtructed part of a Body becomes *ichorous*, and is ſo corrupted as to become *laudable Pus*, which at laſt becomes *ſerous*, *acrimonious*, and almoſt *corroſive*. But 3. This balſamick thickening of the Liquor was never yet obſerv'd; for all Plants that live in the Winter are obſerv'd to be as juicy at *Chriſtmas* as *Midſummer*, and this Juice is as thin in the one Seaſon as the other, which neceſſarily implies its circulating throughout the whole Year.

He ſays, (*Philoſoph. Tranſact.* N°. 349. *p.* 487.) *The Seaſons of Motion in Plants, are the ſame with thoſe Animals which ſleep during the Winter.* This is for want of diſtinguiſhing betwixt the Animal and Vegetative Life; for *Swallows* and *Cuckoo's*, *&c.* have their Blood circulating in the proper Veſſels, though its Motion is perhaps not ſo quick in the Winter, as much as it do's in other Animals while aſleep, when the Animal Functions do not exert themſelves.

I ſhall only add in this Place, that the Parenchymatous Fruit has a peculiar Circulation, as I have obſerv'd before in the Parenchymatous Roots; for heretofore they were wont to import *Melons* from *Portugal* and *Spain*, by leaving a good deal of the Stalk adherent to them, the better to entertain this *Circulation*, which is called the feeding of them. *Oranges* and *Lemons* are pull'd green from the Tree,

otherwiſe they rot in the Importation; and moſt of our Winter-Fruit ripens, after being ſhaken off the Tree. So long as the Circulation continues, the Particles are farther attenuated, and they live; but when that ceaſes they rot as much as the Fleſh of an Animal corrupts and ſtinks when the Animal is dead.

Thus I hope I have prov'd the Circulation of the Sap in Plants, to be the ſame with that of the Blood in Animals, in ſo natural, plain, and intelligible a manner, that after its being ſo fully diſcovered, the Vegetation of Plants needs be no longer a Myſtery. I could have added a great deal more, and explain'd a great many other *Phænomena*, but I doubt not what I have ſaid may be a means to engage others to make farther Improvements upon theſe Hints.

APPENDIX.

APPENDIX

To be added to p. 271. l. 22.

DILLENIUS confirms my Aſſertion, that the *Apices* are never wanting in all *Flowers*, by the Example of the

" DYCOTOPHYLLUM, where he obſerves, " that this being a Water-Plant, has naked " and ſolitary Seeds, *i. e.* one Seed to each " Flower: That both Flowers and Seeds are " ſurrounded by certain *Laciniæ*, and that " the Flowers have neither *Petala* nor *Sta-* " *mina*, but only *Apices*; and though con- " trary to moſt of the other Water-Plants " (for the Flowers in them often mount above " the Water when they begin to ſpring forth) " theſe *Apices* are uſually dip'd in the Wa- " ter; if they are ſqueez'd or preſs'd, as in " the Heads of the *Muſci*, they ſhed a ſoft " and pulpous Matter (like that which is " found in the unripe *Apices)* which being " dry'd, appears globulous by a Microſcope. " He has not yet obſerv'd whether theſe *A-*

" *pices*

" *pices* burſt in the Water, for all he has ſeen " were whole, though ſome of the Seeds were " almoſt ripe; which ſhews, that though they " were not open, yet there is no doubt the *ſe-* " *minal Effluvia* might flow from them, and " impregnate the Seed, becauſe the *Apices* " are very near to them. Nor, perhaps, is " it neceſſary that the *Apices* ſhould burſt, " and be like ſuch of the airy *Apices (aë-* " *reorum Apicum inſtar)* as are upon Land- " Plants, which ſhed the Duſt to cover " the Seed, when 'tis as reaſonable to ſup- " poſe, that in the form of a Juice the " Matter might flow from the *Apices* in- " to the Water, and be ſo convey'd as to " impregnate the Seed. And this ſeems to " him no ſmall Argument that the *Apices* in " the *Hippuris* are after the ſame manner, " and that they are only flowering *Globuli* " or *Folliculi.* This Plant is call'd *Equiſe-* " *tum paluſtre Ramoſum & aquis immer-* " *ſum. Millefolium aquaticum cornutum,* " C. B. *Raii Hiſt.* p. 191. Though in his " Supplement, *p.* 122. he makes the *Mille-* " *folium aquat. cornutum,* C. B. to be dif- " ferent from the *Millefolium aquat. cornu-* " *tum,* J. B.[a]. This Obſervation anſwers to what is ſaid, *p.* 299. and likewiſe ſhews *Dil-lenius* to be of the Opinion, that it's the *Effluvia* which impregnates, and not the

[a] Dillen. Nova Plantarum Genera, p. 91. Tab. iii.

Farina

Farina in Substantia, which becomes the Seed.

To be added to the same Page, Line ult.

Boccone gives the following Account of the *Palma Dactylifera*, which he calls *Pistacium Mas Siculum Folio Nigricante*. " This " Tree is Male and Female. The *Mas* has " its Leaves oval, oblong, thick and dark- " green arising regularly by three and three, " upon a Pedicle, whereof there is one Pair " and an odd one at the Extremity. The " Flowers are thick set *racematim dispositi è* " *foliorum alis*. The Female Tree has its " Leaves of a lighter green, larger, harder, " and consisting of five Leaves upon a Pedi- " cle. The *Embryones* are *Spicatim Dis-* " *positi*.

" When they are at a great Distance from " each other, they fecundate the Fruit, and " make it swell or conceive after the follow- " ing Manner. They wait until the *Embry-* " *ones* of the *Fœmina* begin to appear; they " take a Branch of the *Pistacium Mas*, and " place it in a Vessel surrounded with Earth, " and moisten'd with Water; this they hang " upon a Branch of the *Pistacia Fœmina*, " where they suffer it to remain until the " Flowers are blown, the *Apices* have burst, " and the Dust is shed, and blown by the Wind " over all the *Pistacia Fœmina*. By this " Means the Fruit of the *Pistacia Fœmina* is " impregnated and begins to swell. " The

" The *Piſtacium Mas* flowers before the " *Fœmina*. There is another way of fecun- " dating the *Embryones* of the *Fœmina*. They " take the Buds of the Flowers of the *Mas*, " and put them in a Bag of thin Lawn, and " when they are dry they duſt over all the " Female Tree with the *Powder* or *Farina* " from this Bag. 'Tis neceſſary to take the " Flowers before they are blown, for they " very ſoon ſhed the Duſt, which is of a yel- " low Colour. The Peaſants uſe to try this " Experiment, by taking a little of this Duſt " of the Male-Flowers, and laying it upon " the *Embryones* of the *Fœmina*, they ob- " ſerve ſhortly thereafter, that they begin to " ſwell as a Woman uſes to conceive after " ſhe has been impregnated by a Man.

" It is obſerv'd, that if the Male Duſt is " ſhed before the Female begins to germinate " or bud, in this Caſe the Fruit ſhall not fill, " but be ready to abort and miſcarry, there- " fore they provide themſelves with the dry'd " *Male-Flowers*, that they may duſt the " Fruit over, and diſpoſe it to encreaſe and " ripen.

" When there are a great many Male and " Female-Trees together, they are not ſo " careful to preſerve the Male-Flowers, be- " cauſe the Duſt is blown by the Wind, and " communicates the *prolifick Virtue* to the " Fruit upon the Female Tree of its own ac- " cord.

" They

" They are so careful over all *Sicily* to pro-
" vide themselves with the Male-Flowers,
" and so exact in their Observation, that they
" know when such Branches of the Female-
" Tree have been dusted over with the *Fa-*
" *rina*, for then they will produce Fruit
" abundantly; and if any of the Branches
" seem to fail in the Fructification, then they
" strew them over with the Dust.

By this Account, which may be seen at large in *Boccone*[a], it appears he is of the Opinion, that the *Effluvia* from the *Farina*, impregnates the Seed, as well as *Dillenius* and the several fore-mentioned Authors.

To be added to Mr. Fairchild's Experiment *of the* Circumcision, *p.* 391. *l.* 20.

If only an Inch of this Bark is taken off in the Month of *May*, against the latter end of *August*, the Bark shall encrease downwards, and join with the lower part of the Incision. In that Case it shall put forth Wood-Shoots next Year; but it shall still continue to fructify more plentifully until the whole Incision is supply'd with Bark; but if the Incision is three or four Inches long, then the Bark do's not so readily join. This shews that the Bark has distinct nourishing Vessels from the

[a] Boccone *Museo di Fisica & di esperienze variato, & decorato di Osservazioni Naturali. Osservazione quarentesima quarta*, p. 282. *Museo di piante rare della Sicilia, Malta, &c. p.* 139. *Edit. Venet.* 1697.

Wood

Wood, and that the Sap descends as well as ascends by the Bark. 2. He made an Experiment by topping of Fruit-Trees thus: He chose two young Pear-Trees of the same Soil, and of an equal Growth; he topp'd the one in *September* by taking off several of the Vernal and Autumnal Shoots of that Year. The other he topp'd in the Spring following; and that which he topp'd in the Spring, push'd forth longer Shoots than that which he top'd in the Autumn, by which it appears that the Sap took another Course in the Autumn, and was bestow'd upon the Nourishment of the Bark, so that it did not so soon ascend in a direct Line as that which was topp'd in the Spring, when the Sap had not been diverted from its direct Ascent and Descent during the Winter.

FINIS.

PHiloſophical Letters between the late learned Mr. *Ray* and ſeveral of his Ingenious Correſpondents, Natives and Foreigners. To which are added thoſe of *Francis Willughby* Eſq; the whole conſiſting of many curious Diſcoveries and Improvements in the Hiſtory of Quadrupeds, Birds, Fiſhes, Inſects, Plants, Foſſiles, Fountains, *&c.* publiſhed by *W. Derham*, F. R. S. *&c.* 8°.

Raii Hiſtoria Plantarum. Two Vol. Fol.

——— Tomus tertius: qui eſt Supplementum duorum præcedentium, cum Acceſſionibus Camelli & Tournefort. Fol. 1704.

——— Methodus Plantarum emendata & aucta, in quâ Notæ, maximè Characteriſticæ exhibentur, quibus Stirpium Genera tum ſumma, tum infima cognoſcuntur, & à ſe mutuò dignoſcuntur, non neceſſariis omiſſis, accedit Methodus Graminum, Juncorum & Cyperorum Specialis. Eodem Auctore. 8°.

——— Stirpium Europæarum extra Britannias naſcentium Sylloge. 8°.

——— Synopſis Methodica Stirpium Britannicarum tum indigenis tum in Agris cultis, Locis ſuis diſpoſitis, additis Generum Characteriſticis, Specierum Deſcriptionibus, & Virium Epitomis. Editio ſecunda: in quâ præter multas Stirpes & Obſervationes curioſas ſparſim inſertas; Muſcorum Hiſtoria negligenter hactenus & perfunctoriè tradita plurimum illuſtratur & augetur, additis deſcriptis centum circiter ſpeciebus (totidemque Fucorum atque etiam Fungorum) novis & indictis. Acceſſit Cl. Viri. D. Aug. Rivini Epiſtola ad Joan. Raium de Methodo: cum ejuſdem Reſponſoria, in quâ, D. Tournefort Elementa Botanica tanguntur. 8°.

Phyſico-Theology; or a Demonſtration of the Being and Attributes of God, from his Works of Creation; with large Notes, and many Curious Obſervations. By *W. Derham*, M. A. *&c.* Fourth Edition. 8°. 1716.

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Original

Original of Fountains, of formed Stones, and Sea-Fiſhes Bones and Shells found in the Earth; the Effects of particular Floods, and Inundations of the Sea; the Eruptions of *Vulcano's*; the Nature and Cauſes of Earthquakes. Alſo an Hiſtorical Account of thoſe two late remarkable ones in *Jamaica* and *England*. With practical Inferences. By *John Ray*, late Fellow of the *Royal Society*. The Third Edition, illuſtrated with Copper Plates, and much more enlarged than the former Editions, from the Author's own MSS. 1713. Publiſhed by the Reverend Mr. *Derham*.

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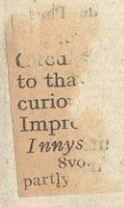



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