

Tracts relating to natural history / By James Edward Smith.

Contributors

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The Marquis of Stafford.

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T R A C T S

NATURAL HISTORY.

T R A C T S

RELATING TO

NATURAL HISTORY.

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NATURAL HISTORY.

T R A C T S

BY
RELATING TO

JAMES EDWARD SMITH, M.D. F.R.S.

ETC. ETC.

NATURAL HISTORY.

"I will let me ransom Hebrew Isaac:
The world's my horse, but Christ's my King,
And God is every where."

Psalm

L O N D O N

PRINTED FOR THE AUTHOR, BY J. DAVIS, AND SOLD BY
J. WHITE, FLEET-STREET.

1798.

T R A C T S

RELATING TO

NATURAL HISTORY.

BY

JAMES EDWARD SMITH, *M.D. F.R.S.*

ETC. ETC.

PRESIDENT OF THE LINNÆAN SOCIETY.

“ Still let me various Nature scan:
The world's my Home, my brother Man,
And God is every where.”

PETRIE.

L O N D O N :

PRINTED FOR THE AUTHOR, BY J. DAVIS, AND SOLD BY
J. WHITE, FLEET-STREET.

1798.

To JAMES CROWE, Esq.

FELLOW OF THE LINNEAN SOCIETY

RELATING TO

DEAR SIR,

I have the pleasure to now revisit the
 hands of my youth, and remark
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 recurring to that still more early
 literary attempts, I cannot help
 IN reviewing some of my first



TO JAMES CROWE, Esq.

FELLOW OF THE LINNÆAN SOCIETY.

DEAR SIR,

IN reviewing some of my first literary attempts, I cannot help recurring to that still more early period, when your partial encouragement and assistance led me on in the pursuit of our favourite Science, and when it was as improbable that my endeavours should ever be of use to the world, as that I should write a book worth dedicating to you. While with pleasure I now revisit the haunts of my youth, and remark many a wild flower from which I

have formerly derived instruction or delight; while I cultivate and enjoy your constant unabated friendship; it is with double satisfaction I recollect, and gratefully acknowledge, how much of my earliest progress is to be attributed to you. May we for a long time to come enjoy together the same pursuits, which afford equal and certain gratification at every period of life, to inexperienced curiosity, and to ripened judgment and knowledge.

Believe me ever,

My dear Sir,

Your obliged and

Faithful servant,

J. E. SMITH.

NORWICH,

Jan. 1, 1798.

P R E F A C E.

ABOVE twelve years have now elapsed since the first piece in this Volume, a beautiful recommendation of the Study of Natural History prefixed by Linnæus to his *Museum Regis*, was originally printed in English. This, my first literary undertaking, was favourably received, as several more arduous ones have since been; and a second edition of the translation has often been desired. It is now given, with the original Introduction and Notes, and some trifling corrections.

The second article in the present Volume is a Discourse on the Rise and Progress of Natural History, delivered at the opening of the Linnæan Society in 1788, and printed in the First Volume of that

Society's Transactions. I have been induced to reprint this Essay by the persuasion of several persons, who may be deemed Admirers rather than Students of Nature, and who therefore have declined purchasing so large a work as the Transactions themselves. I have the more readily acceded to this request, as it gives me an opportunity of enriching the original with the Notes of Father Fontana, the celebrated mathematical professor of Pavia, who published an Italian translation of this Discourse, which has gone through two editions.

The paper on the Irritability of Vegetables, from the Philosophical Transactions for 1788, was reprinted by the editors of the New Annual Register, and appeared also in Rosier's Journal the same year. It chiefly regards the mode of impregnation in the Barberry, about which some Naturalists are still misinformed. The great M. de Jussieu for instance, in his *Genera Plantarum*, published at Paris in 1789, p. 287, attributes

butes the motion of the stamina in this plant, to their being held between the two glands at the base of each petal, and delivering themselves by their elasticity; an hypothesis which the slightest examination of the flower will set aside.

The fourth, fifth, sixth, and seventh articles of the present Volume consist of criticisms upon some publications in Natural History, which were written for the Analytical Review. They are now reprinted merely to shew all I have composed, or ever mean to publish, in this way. It appears to me that an Author who is known should never publish anonymously upon scientific subjects. It is wasting his information and his authority. For matters of fact, the world has a right to know whom it may trust; and as to matters of opinion, a man ought to advance none that he cannot or dares not defend; at least upon subjects where, happily for truth, there is nothing to be got by opposing him. Indeed even these Reviews would never have been written, had

had it not been apprehended that some of the books in question were not likely to be noticed as they deserved; particularly Mr. Curtis's Magazine, a most pleasing and useful work, to which the Public has since done justice. The remarks upon Dr. Berkenhout's publication were composed from a similar motive, though it was not possible to avoid intermixing some censure with the praise this work generally merited. It appears by the Preface of the same author's Letters to his Son, that my criticisms gave him high offence. They perhaps led him to re-peruse his book, and then he would easily discover how much greater severity it deserved upon all the points to which they alluded; and though he corrected himself by them in a subsequent edition, he could never pardon the critic; for I have had occasion elsewhere to observe, that "the greatest offence is that of being in the right;" and this is another reason why a person who wishes to avoid a hornet's nest, can scarcely be an honest reviewer.

The

The eighth article in this Volume is indeed a sufficiently unrestrained composition of the same kind, but at this time of day it can hurt nobody. It has never before been printed, having been written on an emergency, in want of more solid matter, for the entertainment of the Linnæan Society, without any intention of publication. The only apology I can offer for printing it now is its curiosity, for the subject is uselefs.

This paper is followed by three botanical ones, which having never appeared in English, and containing, it is hoped, useful practical information, are now with the most satisfaction laid before the Public. The best occupation of a Naturalist is the actual observation of Nature. This will always reward his care, and improve his judgment. He may indeed learn much from the labours of others, and may but too often have occasion to congratulate himself on the detection of errors, from which the greatest men are not exempt; for what genius is equal

equal to the wisdom of Nature? But the best use to be made of the mistakes of others, is to learn circumspection ourselves.

It is proper to observe, that an elegant plate of the *Sprengelia incarnata* has been published by Mr. Andrews, in a work he has lately commenced, to which I should gladly have referred, had it come to my knowledge before the sheet in which I have described that plant had been printed. I have also learned by a letter from Sweden, that the paper on *Westringia* is now actually printed in the Stockholm Transactions.

The concluding paper in this Volume is on a subject similar to the three preceding, but has not hitherto been any where published. Its contents are too miscellaneous for any purely botanical publication, though they may not prove uninteresting to readers on whose hearts the Study of Nature has had its proper and natural effect.

CON-

Vol. 2. for March 1789.

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TRANSLATOR'S PREFACE

TO THE FIRST EDITION.

I.

THE fine Treatise now offered to the Public, in the Preface to the *Museum Botanicum*, is a work containing a description of the various natural productions of the Kingdom of the

ON THE
STUDY OF NATURE.

Translated from the Latin of the Celebrated

L I N N Æ U S.

“ — look thro' Nature up to Nature's God.”

B

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title

TRANSLATED FROM THE LATIN OF LINNÆUS

I.

REFLECTIONS

STUDY OF NATURE.

Translated from the Latin of the Celebrated

LINNÆUS

“—and the Nature of the Natural God.”

B:

TRANSLATOR'S PREFACE

TO THE FIRST EDITION.

THE little Tract now offered to the Public, is the Preface to the *Museum Regis Adolphi Friderici* of Linnæus; a work containing descriptions of the various natural productions in the Museum of the late King of Sweden, printed in 1754, at his Majesty's expence.

The Linnæan Library coming into the possession of the Translator, this publication particularly engaged his attention; as containing one of the best general views of the œconomy of Nature that he has met with, as well as the most candid and rational recommendation of the study of Natural History.

A desire of giving others the same pleasure which he experienced, has made him attempt putting this Preface into an English dress; especially as the book to which it belongs, one of the most superb and expensive of all Linnæus's works, is very

4 LINNÆUS ON THE STUDY OF NATURE.

little known in this country. The name of its Author, as Mr. Stillingfleet formerly remarked, is in every body's mouth; but probably many people have heard of him without precisely knowing how much the science of Natural History, and many useful arts, are indebted to him; and not a few have criticised his publications, without knowing any thing of him, or understanding his works: time and experience, however, have established his merit, and nearly silenced all his opponents.

The dignity and importance of a philosophical enquiry into the works of Nature, are sufficiently proved in the following pages. At the same time, every attempt, however feeble, to add to the general stock of knowledge, should be encouraged; especially in a science founded, as this is, on observation. Even collectors of natural productions, who have little or no scientific knowledge, deserve commendation, as their labours are of use to those who have not the means of collecting for themselves.

All persons, however, who follow any particular
particular

particular pursuit, are often exposed to very mortifying questions respecting the use of their enquiries. And it must be confessed, that the community has a right of examining every man's employment, in order to give him his just degree of estimation as a member of society.

Questions of this nature coming from the generality of mankind, may be easily answered, by telling them some striking fact, in which their health, safety, or profit is concerned; or by giving the more sensible and ingenuous a view of something that may interest more amiable feelings. For the latter this little work is principally intended: those who have not time or inclination to look farther into the study which it treats of, may get some information from it, and may at least learn that this science richly deserves the attention of some part of mankind.

One fact, which all may learn from it, is, that the study of Nature does not necessarily tend to make a man irreligious, as some weak people have been made to

believe. A number of illustrious examples might be produced to the contrary; none more eminent than the excellent Author of this work, whose unaffected cheerfulness and uniform benevolence gave, in his lifetime, the most unequivocal proofs of the goodness of his heart, as his various publications do of his genuine piety.

Indeed it is difficult to conceive how an opinion so absurd as the above could gain any ground: it must surely have been strengthened by the conduct of those triflers in philosophy, who mistake whim and affectation for genius; aim at, and imagine they attain, every science, by new paths untried before; and have a great facility at resolving every thing, which they cannot comprehend, into absurdity and imposition. Or it must have been countenanced by those pretenders to science, who having entered on a profession, the foundation of which ought to be the observation of Nature, think it necessary to affect universal knowledge. What these people

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cannot

cannot attain they treat with contempt; they pollute the holy fountain of truth with their crude and often malicious effusions; and are only preserved from general scorn by the intricacy of Nature, and the short-sightedness of mankind.

Such critics as these frequently molest the patient traveller in the path of science, as well as the honest investigator of moral truth, with questions tending only to perplex, and with remarks less calculated to assist than to confound. Unprofitable indeed may that pursuit be esteemed, the prosecution of which is not preferable to a controversy with such men! He whose good-nature should induce him to try to enlighten them, would probably find them as incapable of improvement as of candour; as unskilful perhaps in what they ought to know, as illiberal in their censures of what they do not even profess to understand.

But nothing affords a more humiliating view of human wisdom, than when we see men of real learning and skill in particular

branches, treating the scientific pursuits of others with contempt. How much soever such men may excel in their own science, and how lofty and important soever that science may be, they can neither be esteemed true philosophers, nor friends of mankind. A certain portion of enthusiasm in our favourite pursuits is natural; it is even necessary to the attainment of an eminent degree of success in them: but when it becomes inordinate, it is always ridiculous, and often guilty; it gives the world reason to suspect that its possessor has attached himself to a single branch of knowledge, at the expence of all wisdom and virtue besides.

The editor of this little work has taken the liberty of making the names of the animals mentioned in it agree with Linnæus's last edition of his *Systema Naturæ*; in other respects the translation is in general pretty near the original: if it be found intelligible, the Translator's principal end will be answered.

June, 1785.

REFLECTIONS

ON THE

STUDY OF NATURE.

THOSE who visit museums of natural productions, generally pass them over with a careless eye, and immediately take the liberty of giving a decided opinion upon them. The indefatigable collectors of these things sometimes have the fate of being reckoned monsters: many people wonder at their great but useless labours; and those who judge most tenderly, exclaim, that such things serve to amuse persons of great leisure, but are of no real use to the community. It shall therefore be the business of this discourse to examine the design and end of such collections.

The knowledge of one's self is the first step towards wisdom: this was the favorite precept of the wise Solon, and was
written

written in letters of gold on the entrance of the temple of Diana.

A man surely cannot be said to have attained this self-knowledge, unless he has at least made himself acquainted with his origin, and the duties that are incumbent upon him.

Men, and all animals, increase and multiply in such a manner, that, however few at first, their numbers are continually and gradually increasing. If we trace them backwards, from a greater to a lesser number, we at length arrive at one original pair. Now mankind, as well as all other creatures, being formed with such exquisite and wonderful skill, that human wisdom is utterly insufficient to imitate the most simple fibre, vein, or nerve, much less a finger, or other contriving or executive organ; it is perfectly evident, that all these things must originally have been made by an omnipotent and omniscient Being; for "he who formed the ear, shall he not hear? and he who made the eye, shall he not see?"

Moreover,

Moreover, if we consider the *generation* of Animals, we find that each produces an offspring after its own kind, as well as Plants, *Tanias*, and Corallines; that all are propagated by their branches, by buds, or by seed; and that from each proceeds a germ of the same nature with its parent; so that all living things, plants, animals, and even mankind themselves, form one "chain of universal Being," from the beginning to the end of the world: in this sense truly may it be said, that there is nothing new under the sun.

If we next turn our thoughts to the place we inhabit, we find ourselves situated on a vast globe of land and water, which must necessarily owe its origin to the same Almighty Being; for it is altogether made up of wonders, and displays such a degree of contrivance and perfection, as mortals can neither describe nor comprehend. This globe may therefore be considered as a museum, furnished with the works of the Supreme Creator, disposed in three grand classes.

If,

If, in the first place, we consider the Fossil Kingdom, we shall see the manner in which *water* deposits *clay*; how it is crystallized into *sand* near the shore*; how it wears down *shells* into *chalk*, dead *plants* into *vegetable mould*, and *metals* into *ochre*; from all which substances, according to the laws of Nature, *stones* are formed; thus from *sand* originates *whetstone*, from *mould* *slate*, from *chalk* *flint*, from *shells* and *earth* *marble*, and from *clay* *talc*. In the cavities of these, concrete beautiful pellucid *crystals*, which consisting of various sides opposed to each other, form a number of regular figures, which the most ingenious mathematician could scarcely have invented, and among which the glittering *gems* and brilliant *adamant* find a place.

Here the ponderous and shining *metals* are constantly forming; the ductile *gold*†,

* This opinion of the crystallization of sand from water is disputed by the mineralogists of the present day.

† *Lentum aurum*.

which

which eludes the violence of fire, and which can be extended in length and breadth to an almost incredible degree: here is found the wonderful *magnet*, of which no mortal has hitherto been able to learn the secret law of its mutual attraction with iron, or of its constant inclination towards the poles.

The various strata of stones often concealed in the highest summits of the Alps, are most ancient monuments, which place before our eyes the many changes of the old globe, and proclaim them to us, whilst all other things are silent on the subject.

The innumerable *petrifications* of foreign animals, and of animals never seen by any mortal in our days, which often lie hid among stones under the most lofty mountains, are the only remaining fragments of the ancient world, and reach far beyond the memory of any history whatever,

So large a quantity of these and other stones covers the globe, that no man has hitherto been able to break through them,

but

and

and penetrate to the originally created earth.

In the second place, the Vegetable Kingdom offers itself to our contemplation. Of all its productions, the first covering of the earth was furnished by the wintry *mosses*; of such variety in their forms, that they scarcely yield to herbs in number; and although extremely minute, yet of so admirable a structure, that they undoubtedly excel the stately Palms of India. These mosses are dried up in summer, but in winter they revive, and in the early spring guard the roots of other plants from cold, as they afterwards do from the injuries of summer suns.

For the gratification of our eyes, the earth is every where covered with verdure: there is no soil so rich or so barren, none so dry or so boggy, mountainous or marshy, exposed or shady, that some peculiar species of grass does not freely grow there, and fill up the interstices between other plants.

The widely disseminated *herbs*, distinguished

guished by the various forms of their leaves, flowers, and fruits, decorate the earth in the most agreeable manner; not one of them but has its end and office assigned it by the Supreme Governor of the world: numerous as they are, they most of them differ from one another in taste and smell, form and colour, powers and properties; but especially in their flowers, which attract our notice by their elegant variety; and in them we discover the amours of plants, by which, although unattended with sensation, they develop their internal structure*, and overspread the globe.

Trees, whose roots being raised high above the earth, constitute what we call a stem, weave their branches into an agreeable shade, to defend the ground from excessive heat and cold, and to shelter men from the injuries of the weather,

* This refers to a theory of the Author's, the solidity of which may be doubted. Those who wish to see more of it, may consult the *Amœnitates Academicæ*, Vol. vi. Dissertation 1.

The third division contains the Animal Kingdom, where the various kinds of *worms* filently occupy the bottom of the sea; some of which, united in a manner by social compact, build *corals*, others lead a solitary life concealed in their horny shells, which are constructed with such beauty and variety in their figures, that no human wisdom can trace them out or comprehend their numbers.

Such numberless swarms of armed *insects* fly about the earth, that their species are more numerous than all that the ground produces. These, in their infancy, are disguised in the form of *caterpillars*, in which state each has its proper plant assigned it, which it is appointed to inhabit and to feed upon, that the inordinate increase of any one may be prevented. Hence those vegetables whose luxuriant branches other animals cannot touch, either on account of prickles or height, or of a certain fœtor or acrimony peculiarly obnoxious to their senses, are obliged to afford entertainment to a number of insects;

so that while many plants are destined to feed a very few species of these animals, the nettle affords subsistence to several different kinds; and trees, being out of the reach of quadrupeds, frequently support innumerable legions.

The dumb *fishes* which glitter at the bottom of the waters, and which surpass birds in number, find an ample repast prepared for them in the numberless worms which have their dwelling there: and at the summons of Venus they in their turns annually approach the shore in duly divided troops.

The winged inhabitants of the air, which excel all other animals in the beauty of their forms, find in the loftiest trees a rich provision of insects for their sustenance: here they modulate their harmonious throats to the tender melody of love, preparatory to their producing new tribes for the ornament of future seasons. Most birds migrate every year from the northern shores to countries nearer the sun; and, having reached their appointed dis-

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tance,

tance, return for the purpose of disseminating plants and fishes*.

Quadrupeds, which wander and sport in the fields, convert all other things to their use: by their joint endeavours they purge the earth from putrefying carcases; by their voracious appetites they fix bounds to the number of living creatures; they join in the contracts of love; and, when urged by hunger, unite in pursuit of their prey. Thus, whilst all things are purified, all things are renewed, and an equilibrium is maintained; so that of all the species originally formed by the Deity, not one is destroyed.

While we turn our minds to the con-

* Pulpy fruits are in general the food of a variety of birds as well as of quadrupeds; but the seeds which are contained in these fruits are of such a nature, that they almost always pass through the animal unhurt, and rather more fit for vegetation than before: thus they are transported to places far from their native soil. The spawn of fishes often shares the same fate.—See Linnaeus's *Oratio de Telluris Incremento*, *Amœn. Acad.* vol. ii. published in English by the Rev. Mr. Brand, among his *Select Dissertations from the Amœnitates Academicæ*.

templation of the beauties which surround us, we are also permitted to employ them for our benefit: For to what use would the sun display its beams? for what end would the spacious world be furnished by the great and bountiful Author of nature, were there no rational beings capable of admiring and turning it to their profit? The Creator has given us *eyes*, by the assistance of which we discern the works of creation. He has, moreover, endowed us with the power of *tasting*, by which we perceive the parts entering into the composition of bodies; of *smelling*, that we may catch their subtle exhalations; of *hearing*, that we may receive the sound of bodies around us; and of *touching*, that we may examine their surfaces; and all for the purpose of our comprehending, in some measure, the wisdom of his works. The same instruments of sensation are bestowed on many other animals, who see, hear, smell, taste, and feel; but they want the faculty which is granted us, of combining these sensations, and from thence

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drawing

drawing universal conclusions. When we subject the human body to the knife of the anatomist, in order to find in the structure of its internal organs something which we do not observe in other animals, to account for this operation; we are obliged to own the vanity of our researches: we must therefore necessarily ascribe this prerogative to something altogether *immaterial*, which the Creator has given to man alone, and which we call *soul*.

If therefore the Maker of all things, who has done nothing without design, has furnished this earthly globe, like a museum, with the most admirable proofs of his wisdom and power; if, moreover, this splendid theatre would be adorned in vain without a spectator; and if he has placed in it Man, the chief and most perfect of all his works, who is alone capable of duly considering the wonderful œconomy of the whole; it follows, that Man is made for the purpose of studying the Creator's works, that he may observe in them the evident marks of divine wisdom.

Thus

Thus we learn, not only from the opinions of moralists and divines, but also from the testimony of Nature herself, that this world is destined to the celebration of the Creator's glory, and that man is placed in it to be the publisher and interpreter of the wisdom of God : and indeed he who does not make himself acquainted with God from the consideration of nature, will scarcely acquire knowledge of him from any other source ; for, “ if we have
“ no faith in the things which are seen,
“ how should we believe those things
“ which are not seen ?”

The brute creation, although furnished with external senses, all resemble those animals which, wandering in the woods, are fattened with acorns, but never look upwards to the tree that affords them food ; much less have they any idea of the beneficent Author of the tree and its fruit.

If our probation had been the only object of Divine Wisdom in forming the world, it would have been sufficient for

that wisdom, which does nothing in vain, to have produced an indigested chaos, in which, like worms in cheese, we might have indulged in eating and sleeping: food and rest would then have been the only things for which we should have had an inclination; and our lives would have passed like those of the flocks, whose only care is the gratification of their appetite. But our condition is far otherwise.

For the Author of eternal salvation is also the Lord of nature. He who has destined us for future joys, has at present placed us in this world. Whoever therefore shall regard with contempt the œconomy of the Creator here, is as truly impious as the man who takes no thought of futurity. And in order to lead us toward our duty, the Deity has so closely connected the study of his works with our general convenience and happiness, that the more we examine them, the more we discover for our use and gratification. There is no land so barren and dreary, that any one who should come there need perish
with

with hunger, if he knew the bodies which it produces, and how to use them properly; and we see constantly, that all rural and domestic œconomy, founded on the knowledge of nature, rises to the highest perfection, whilst other undertakings, not deduced from this science, are involved in insurmountable difficulties.

The magnificence and beauty, the regularity, convenience, and utility of the works of creation, cannot fail to afford man the highest degree of pleasure; so that he who has seen and examined most of these, must the more perfectly admire and love the world as the work of the great Creator, and must the more readily acquiesce in his wise government. To be an interpreter of the perfect wisdom of an infinite God, will by him be esteemed the highest honour that mortals can attain. Can any work be imagined more forcibly to proclaim the majesty of its author, than a little inactive earth rendered capable of contemplating itself as animated by the hand of God? of studying the dimensions

and revolutions of the celestial bodies, rolling at an almost infinite distance, as well as the innumerable wonders dispersed by the Creator over this globe? in all which appear manifest traces of divine wisdom and power, and the consideration of which affords so much delight, that a man who has tasted it would cheerfully prefer it to all other enjoyments.

Nature always proceeds in her accustomed order, for her laws are unchangeable; the omniscient God has instituted them, and they admit of no improvement.

It is so evident that the continent is gradually and continually increasing by the decrease of the waters, that we want no other information of it than what nature gives us: mountains and valleys, petrifications and the strata of the earth, the depths of the ocean and all the various kinds of stones, proclaim it aloud. As the dry land increases at this day, so it is probable that it has all along gradually extended itself from the beginning: if we therefore enquire into the original appearance

ance of the earth, we shall find reason to conclude, that instead of the present wide-extended regions, one small island only was in the beginning raised above the surface of the waters.

If we trace back the multiplication of all plants and animals, as we did that of mankind, we must stop at one original pair of each species. There must therefore have been in this island a kind of living museum, so furnished with plants and animals, that nothing was wanting of all the present produce of the earth. Whatever nature yields for the use or pleasure of mankind was here presented to our first parents; they were therefore completely happy. If that favoured man was obliged to acquire the knowledge of all these things in the same order, and according to the same laws of nature to which we are subject, that is, by means of the external senses; he must have taken a view of the nature, form, and qualities of each animal, in order to distinguish it by a suitable name and character: so that the chief employment

ment of the first man, in this garden or museum of delights, was to examine the admirable works of his Creator.

Among the luxuries therefore of the present age, the most pure and unmixed is that afforded by collections of natural productions. In them we behold offerings as it were from all the inhabitants of the earth; and the productions of the most distant shores of the world are presented to our sight and consideration: openly and without reserve they exhibit the various arms which they carry for their defence, and the instruments with which they go about their various employments; and whilst every one of them celebrates its Maker's praise in a different manner, can any thing afford us a more innocent pleasure, a more noble or refined luxury, or one that charms us with greater variety?

To man, made for labour, due intervals of relaxation are no less necessary, than sleep is to the body when exhausted by watching; and truly unhappy may that mortal be reckoned, to whom nothing af-

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fords amusement. He who is exhausted by the more weighty labours, has the greatest need of rest: but rest, not tempered with pleasure, becomes torpid insensibility. The principal reward of labour, which the Creator has granted to man, is leisure with enjoyment; and mortals generally exert their utmost efforts to obtain it.

Almost all princes have had their favourite amusements to refresh them when fatigued with business. Some of them, in early times, when men had scarcely left off eating acorns, employed their leisure hours in feasting and dancing, in games and useless sports, wrestlings, or other public exhibitions, in hunting parties, or in the seragios of women: but when the fields began to glow with the riches of Ceres, these lords of the earth sought for more refined gratifications; and at length some of them have employed their leisure hours in collecting Nature's productions. Fame has long celebrated the museum of the Grand Duke of Tuscany. The Queen
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of Portugal is at present engaged in making a collection. The Kings of Spain have bestowed more attention and expence in this way than any other princes ; by their means the rich stores of America have been sought out and examined. The museum of the King of France has scarcely its equal in the world. The Empress Queen of Hungary has ordered all kinds of natural curiosities to be bought for her. The Parliament of England has purchased the excellent collection of Sir Hans Sloane, and dedicated it to public use. The Stadtholder of the United Provinces, a little before his death, fitted up a museum at Leyden ; and Peter I. Emperor of Muscovy, has taken care to buy up all the collections of this kind that he could meet with, in order to enrich a museum with them at Petersburg.

In this manner, the pleasure which results from contemplating the wisdom of the Creator in his works, has been diffused over the globe, and has entered the palaces of princes.

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Our august Monarch, with his Royal Consort, are the first Swedish sovereigns who have fostered these sciences. His Majesty has adorned his splendid museum, in the palace of Ulricisdahl, with a variety of quadrupeds preserved in spirits of wine, a great number of stuffed birds, an innumerable quantity of insects and shells arranged in cabinets: not to mention the valuable Herbarium, and the beautiful Menagerie in which living beasts and birds are kept.

The Queen has taken delight in collecting insects and shells, as well as corals and crystals, from all parts of the world; and has ornamented her palace of Drottningholm with them so successfully, that I doubt whether any other collection of the kind can be compared to it. Thus does this royal pair take pleasure in contemplating the wonderful works of the Creator; and daily behold in them, as in a glass, the signs of his wisdom and goodness.

As the manners and customs which prevail in the world always take their rise in
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the courts of Princes, as from a never-failing spring; whatever magnificence or vanity, whatever luxuries or amusements, whatever conversation and opinions reign there, are for the most part diffused through the whole kingdom: happy is that people who may learn from their superiors to love the works of nature; inasmuch as they beget a veneration for the Deity, and lay the foundation of all œconomy and public felicity.

I know not what to think of those people who can, without emotion, hear or read the accounts of the many wonderful animals which inhabit foreign countries.

What principally strikes us agreeably at first sight is *colour*; of which the good and great Creator has given to some animals a rich variety, far beyond the reach of human art. Scarcely any thing can equal the beauty of birds in general; particularly the brilliant splendour of the Peacock. India, indeed, boasts a number of fishes, whose painted scales almost equal the plumage of birds in beauty; not to mention

mention the Indian fishes, *Trichiurus Lep-
turus* (Sword-fish of Brown's Jamaica) and
Zeus Vomer, whose brilliant white colour
excels the purest and most polished silver :
or the Gold-fish (*Cyprinus aureus*) of the
Chinese, which shines with such golden
splendour, that the metal itself is by no
means comparable to it. People of rank
in India keep the last-mentioned fish alive
in their apartments in earthen vessels, as
in fish-ponds, and feed them with their
own hands, that they may have something
to excite admiration perpetually before
their eyes. The Author of nature has
frequently decorated even the minutest
insects, and worms themselves, which in-
habit the bottom of the sea, in so exquisite
a manner, that the most polished metal
looks dull beside them. The great Golden
Beetle (*Buprestis gigantea*) of the Indies
has its head studded with ornaments like
precious stones, brilliant as the finest gold* :

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* This description is not so applicable to the *Buprestis
gigantea* as to the *Buprestis sternicornis*; for the head of
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and the *Aphrodita aculeata*, reflecting the sun-beams from the depths of the sea, exhibits as vivid colours as the Peacock itself spreading its jewelled train.

The difference of size in different animals must strike us with no less astonishment: especially if we compare the huge Whale with the almost invisible Mite; the former, whilst it shakes the largest ships with its bulky body, is itself a prey to the diminutive *Onisci*, and is obliged to have recourse to marine birds, who, sitting on its back, free it from these vermin.

We are as much amazed at the prodigious strength of the Elephant and Rhinoceros, as we are pleased with the slender Deer of Guinea (*Moschus pygmæus*), which is, in all its parts, like our Deer, but scarcely so large as the smallest Lap-dog: Nature has, however, in the nimbleness of the former is not remarkably brilliant, while both the head and thorax of the latter may justly be compared to gold studded with jewels: but even this animal must yield the palm to some other species of the same splendid family.

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its feet, abundantly compensated this animal for the smallness of its size.

The great Ostriches of Arabia, whose wings are insufficient to raise their bulky bodies from the ground, excite no less admiration than the little Humming-birds of India, hardly bigger than Beetles, which feed on the honey of flowers, like bees and flies, and, like those animals, are the prey of ordinary Spiders; between which and the large Spider of Brasil (*Aranea avicularis*) there is as much difference in size as between the Humming-bird and the Ostrich. This great Spider often attacks the largest birds, dropping on their backs, by means of its web, from the branches of trees; and while they vainly seek for security in flight, it bites them, and sucks their juices in such a manner, that they not unfrequently fall lifeless to the ground.

The singular figures of some animals cannot fail to attract our notice. We wonder, with reason, at the angular appendage to the nose of the American Bat: nor is the short and slender upper man-

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dible of the Indian Woodpecker (*Picus semirostris*) less remarkable; the form of the latter being as unusual among birds as is among fishes the figure of the American Fishing Frog (*Lophius Histrion*), which is furnished with feet, but cannot walk; while another kind of fish (*Silurus Callichthys*), when the rivulet which it inhabits becomes dry, has a power of travelling over land till it finds more copious streams.

The Plaife, the Sole, and many other fishes which constitute the *genus* of *Pleuronectes*, although the only animals which have both eyes on the same side of the head, do not, perhaps, astonish us so much, being common fishes, as the Horned Frog of Virginia (*Rana cornuta*), whose head is furnished with a pair of horns, at the extremities of which its eyes are placed: its stern aspect cannot fail to strike with horror all who behold it. This frog is unable, however, to move its eyes in different directions at the same time, like the Chamæleon, which appears to have a power of contemplating at once many distant

distant objects, and of attending equally to all : for this last animal certainly does not live upon air, as many have reported, but on flies, which it follows with its piercing and sparkling eyes, till it has got so near them, that by darting forth its long tongue they are instantly caught and swallowed. While the slender Ant Bear (*Myrmecophaga*), which has no teeth, and which the Creator has appointed to live upon ants alone, by coiling up its tongue like a serpent, and laying it near an ant-hill, collects the little animals, and devours them entire.

He who has given life to animals, has given to them all different means of supporting it : for if all birds were to fly in the same manner, all fishes to swim with the same velocity, and all quadrupeds to run with equal swiftness, there would soon be an end of the weaker ones.

That wisdom which deliberates on all future events, has covered the Porcupine-fish (*Diodon Hystrix*), like the Hedgehog, on every side with a strong guard of thorns ;

has bestowed on the Armadillo (*Dasyurus*), as on the Tortoise, a hard shell, in which it rolls itself up, and bids defiance to its enemies; and has enveloped the *Loricaria*, like the Canada Pike (*Esox osseus*), with a coat of mail.

The same Almighty Artist has given the Flying Squirrel (*Sciurus volans*) a power of extending the skin on each side of its body in such a manner, that, being enabled to descend by a precipitate flight from one branch to another, it easily avoids its enemies. He has affixed wings to the sides of the little Dragon (*Draco volans*), with which, by the help of its feet, it supports itself in the air in the manner of a Bat. Thus also has he lengthened out the fins on the breast of the Flying Fish, that it might seek for safety in the air, when pursued by its enemies in the water: and he has likewise formed an appendage to the tail of the great Cuttle-fish (*Sepia Loligo*), by means of which it springs out of the sea; at the same time being furnished with a bladder, full of a sort of ink, with

which it darkens the water, and eludes the sight of its pursuers.

Other animals are preserved by means of their dismal cries, as the Capuchin Monkey (*Simia Capucina*), whose horrid yellings are intolerable to the ears; and the Sloth (*Bradypus*), whose piercing voice puts all the wild beasts to flight, like horses at the sound of a rattle. The slow-paced Maucauco (*Lemur tardigradus*) is supplied with double ears, that he may betake himself to the trees in time to avoid danger; there he gathers the fruit in safety, always first tasting what he presents to his mate. The Creator has indulged the Opossum with a retreat for her young in her own body, to which they betake themselves in case of an alarm; and, lest cruel hunger should force them from this asylum, it is furnished with internal nipples, affording them a welcome nourishment. The Torpedo, of all animals the most tender and slow-paced, and therefore most obnoxious to the attacks of others, has received from its Maker a power

denied to other creatures, of giving those who approach it a shock, of such a nature, that none of its enemies can bear it.

Truly formidable are the arms which the Lord of nature has given to some animals. Though he has left serpents destitute of feet, wings, and fins, like naked fishes, and has ordered them to crawl on the ground exposed to all kinds of injuries, yet he has armed them with dreadful envenomed weapons: but, that they may not do immoderate mischief, he has only given these arms to about a tenth part of the various species; at the same time arraying them in such habits that they are not easily distinguishable from one another, as the rest of animals are; so that men and other creatures, while they cannot well distinguish the noxious ones from those which are innocent, shun them all with equal care. We shudder with horror when we think of these cruel weapons. Whoever is wounded by the Hooded Serpent (*Coluber Naja*) expires in a few minutes; nor can he escape with life who

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is bitten by the Rattle-snake (*Crotalus horridus*) in any part near a great vein. But the merciful God has distinguished these pests by peculiar signs, and has created them most inveterate enemies; for, as he has appointed cats to destroy mice, so has he provided the Ichneumon (*Viverra Ichneumon*) against the former serpent, and the Hog to persecute the latter. He has moreover given the *Crotalus* a very slow motion, and has annexed a kind of rattle to its tail, by the shaking of which it gives notice of its approach: but, lest this slowness should be too great a disadvantage to the animal itself, he has favoured it with a certain power of fascinating squirrels from high trees, and birds from the air into its throat, in the same manner as flies are precipitated into the jaws of the lazy toad*.

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* This opinion of the fascinating power of the Toad has been refuted, and the appearance which gave rise to it fully accounted for, by Mr. Pennant, in his British Zoology. Probably the story of the Rattle-snake's having a similar power might be found equally false, if

On account of these and various other poisonous serpents and worms of India, which crawl upon the ground, swim in the waters, or twine among the branches of trees, we prefer our barren and craggy woods to the ever-blooming meadows and fruitful groves of Indian climes; and we had rather suffer the inconveniences of our northern snows, than enjoy their enviable luxuries. We fear no threatening scorpions, which disturb the peace and rest of those who inhabit a warmer climate; nor is our sweet sleep interrupted by the *Scolopendræ*, to guard against which fires are obliged to be carefully kept up all night in India. Our waters are not infested, like those of some other countries; nor do they produce fish whose flesh is poisonous, like the Hare Globe-fish (*Tetrodon lagocephalus*) of the Chinese; nor any whose

enquired into with the same degree of accuracy.—See a “Memoir concerning the fascinating faculty which has been ascribed to the Rattle-snake and other American Serpents.” By B. S. Barton, M. D. Philadelphia, 1796. 8vo. 70 pages.

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bite is venomous, except the *Muræna Helena*, a very rare fish; neither have we any that wounds with poisonous prickles, except the Weever (*Trachinus Draco*), which we can easily avoid. Sharks, which dismember the inhabitants of the eastern world, and devour them in the water, are almost unknown on our shores; as are Crocodiles, which ascend the sides of vessels and take away men for their prey. The ravages of the last-mentioned animal, however, the Creator has restrained within very narrow limits; not only by means of the cruelty with which it devours its own young, and of the bird which destroys its eggs; but also by the Striped Lizard (*Lacerta Monitor*), which informs men of the approach of the Crocodile, as the Great Butcher-bird (*Lanius Excubitor*) warns lesser birds of that of the Hawk. Just in the same manner the human race are preserved from Lions and Tigers, by means of the Little Lizard, called *Gecko*; which being alarmed for its own safety, runs hastily to man, as its guardian angel,
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and acquaints him with his danger : thus also the Storm Finch warns mariners of an approaching tempest.

But the curious properties of exotic animals are so many, that we have only room to mention a few more of the most remarkable. For example ; the Surinam Toad (*Rana Pipa*) nourishes its young on its back, as cattle do the Gadfly. And this is more truly worthy of our admiration than the Salamander, which was believed by the ancients to live in the fire ; or the Frog-fish (*Rana paradoxa*), which was till very lately supposed to be transformed from a toad to a fish. The Black Tortoises always leave the recesses of the sea, to seek out the shores of desert and desolate islands, in the sand of which they deposit their eggs : thus they fall a prey to sailors, who refresh their sick with the delicate flesh of these animals ; which is much more wholesome, although less delicious, than that of the Guana (*Lacerta Iguana*), the latter being prudently avoided by those who have been too incautious

in their sacrifices to Venus. Any one who happens to see, in the Indian woods, the falling leaves of trees apparently become alive, and creep upon the ground*, probably beholds them with no less pleasure than he would the phosphorescent Sea Pens, which cover the bottom of the ocean,

* The appearance here alluded to is caused by the different species of *Mantis*, a kind of insects, whose wings so exactly resemble the leaves of many trees, both in texture and colour, that inaccurate observers, seeing them fall from the branches, and immediately afterwards creep or fly away, conceived the idea of the wonderful and indeed impossible transformation of a leaf into an animal; an idea which is still strenuously supported by many persons who are more used to see, than to reflect on what they behold. Such striking appearances as the above were surely designed to excite our curiosity, and they cannot fail to awaken that of the most inattentive. Many operations of nature, however, which are constantly going on before our eyes, although less striking, are no less curious; nor ought we to suffer our attention to be so far engaged by the wonders of foreign countries, as to neglect the productions of our own; which, besides being more easily examined, are probably more likely to be serviceable in the improvement of our domestic and rural œconomy.

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and there cast so strong a light, that it is easy to count the fishes and worms of various kinds sporting among them. The Sucking-fish (*Echeneis Remora*), which of itself could not without great difficulty swim fast enough to supply itself with food, has obtained from its Creator an instrument not much unlike a saw, with which it affixes itself to ships, and the larger kinds of fishes, and in this manner is transported *gratis* from one shore of the world to another. The same Divine Artificer has given the sluggish Fishing Frog (*Lophius piscatorius*) a kind of rod, furnished with a bait, by which it beguiles little fishes into its jaws*.

Thus he who views only the produce of his own country, may be said to inhabit a single world; while those who see and consider the productions of other climes, bring many worlds, as it were, in review before them.

Of these wonderful animals travellers

* See Pennant's British Zoology.

have told us much ; all accounts of voyages mention them. We may gather knowledge from the accounts of others ; but it is much more pleasant to see things with our own eyes. In this Royal Museum these astonishing creatures are preserved, exhibiting, as nearly as possible, the appearance which they made when living on the theatre of the world ; a most magnificent spectacle to an admirer of the Divine Wisdom !

Man, ever desirous of knowledge, has already explored many things ; but more and greater still remain concealed ; perhaps reserved for far distant generations, who shall prosecute the examination of their Creator's works in remote countries, and make many discoveries for the pleasure and convenience of life. Posterity shall see its increasing Museums, and the knowledge of the Divine Wisdom, flourish together ; and at the same time all the practical sciences, antiquities, history, geography, natural philosophy, natural history, botany, mineralogy, dietetics, pathology,

thology, medicine, materia medica, œconomy, and the manual arts, shall be enriched: for we cannot avoid thinking, that those which we know of the Divine works are much fewer than those of which we are ignorant.

II.

DISCOURSE

ON THE

RISE AND PROGRESS

OF

NATURAL HISTORY,

Read at the Opening of the Linnæan Society,

APRIL 8, 1788.

THE UNIVERSITY OF CHICAGO

PHILOSOPHY DEPARTMENT

DISCOURSE

IN THE

NATURAL HISTORY

OF THE

UNIVERSITY OF CHICAGO

BY

DISCOURSE
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RISE AND PROGRESS
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THE Study of Nature, that is, an attention to the ground on which we tread, the vegetables which clothe and adorn it, and the boundless variety of living creatures presenting themselves to our notice on every side, must have been one of the first occupations of man in a state of nature. In no country hitherto discovered, however barbarous and unenlightened, is the human race found so negligent and helpless as not to have investigated the natural

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bodies around them, so far at least as from thence to supply their necessary wants, and even to obtain conveniences and luxuries. In the more hospitable climes in which probably mankind were first established, this task was the more easy. The calls of nature would there be readily satisfied; and while the senses were gratified with all they were capable of enjoying, the mind, ever prone to curiosity, would be continually exercised and delighted in investigating the creation around it. Then, as the human race multiplied, would the spirit of competition arise for the discovery of hitherto untasted luxuries or unknown conveniences; and he who first climbed the lofty palm-tree, and, while its leafy honours were waving above his head, scattered the golden shower of plenty upon his admiring companions, would deserve and enjoy more real glory, than any destroyer of his fellow creatures ever enjoyed, after those very boughs became prostituted to proclaim the triumph of desolation and war.

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By degrees mankind became so numerous and so adventurous as not only to occupy all that part of the world in which they were first settled, but also to migrate into far distant countries, where ruder skies and less fruitful plains taught them new wants, and put their ingenuity to greater trials. In short, by means and accidents which most likely will long remain a problem for philosophers, the human race became in process of time dispersed over almost every part of the globe where art and labour could find them protection and subsistence. Their various acquirements, in the course of their long laborious progress, must have been all founded on the knowledge and observation of nature; and with so much accuracy have they studied this subject, so interesting to them all, that even in the most advanced state of society, as well as in the lowest, mankind are perfectly agreed upon the uses of most of the necessaries with which nature furnishes them; they have all alike learned precisely to what purpose each is fit, and all supply

the ordinary wants of life, all remove its ordinary inconveniences, much in the same way.

If on the present occasion my principal object were to amuse the fancy, I should dwell long on this early period of the history of the human race. The first probable wants and inventions of mankind; their progress from a state of nature, peace and innocence, to one more turbulent and active, but less natural and happy; the simple origin of each art and science, and especially the source of all human knowledge, in the observation of nature, with the different degrees of cultivation which each science may be supposed to have received according to the various circumstances in which mankind have been—all these things might form a very amusing subject for speculation: but as such disquisitions must be chiefly guided by the imagination, and after all could be only considered in the light of a romance, I must not at present enter upon them. My review of those much later periods, although still
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far remote from us, in which the progress of science begins to be marked, must be even more slight than the traces of its footsteps in the page of history; and we shall easily console ourselves for our ignorance of what former ages have thought and known, when we find how little real advantage is to be derived from the knowledge of those much nearer to us.

In a very early state of society the sum of human knowledge would become too much for every individual to acquire; of course some must necessarily pursue particular arts or enquiries in preference to the rest; and this difference is observable not only among individuals, but also between different nations and bodies of men. In infant states, warlike accomplishments more than any others engage the generality of the citizens, and, because most evidently necessary to the safety of the whole, are held in the highest esteem. But when external danger is kept at a distance, the internal regulations of the state, and the softer arts of peace, become more interest-

ing to those who have talents for cultivating them. A part of the community being sufficient to supply the whole with the necessaries of life, the occupations of the rest becoming voluntary, are as various as the virtues and vices, tastes, genius and abilities of mankind; and the more a people are refined and enlightened, the more various and the more distinctly marked are the pursuits of individuals.

The early history of science informs us rather of peculiar acquirements by which certain nations distinguished themselves from the rest, than of the general stock of knowledge then in the world. Thus we are told of the skill of the Egyptians in astronomy, to which they were peculiarly led by their manner of reposing on open terraces under a cloudless sky. But we are not to conclude that this science had never been cultivated by any people before, nor that the Egyptians, and all the rest of the world, had lived totally void of curiosity, and blind to every thing around them, till their attention was excited by the trivial

vial circumstance above mentioned. We learn from the Old Testament, which, if it were merely an human work, would be the most venerable monument in the world, that Natural History was very early one of the sciences in the highest estimation. Without examining what was the precise degree of Solomon's skill in this science, the manner in which his botanical knowledge is mentioned in the Bible, proves that to have been in those days the most esteemed perhaps of all learning whatever. Yet where are the records of its progress? How totally is the knowledge of those ages and of numberless others lost to us!

As botany and astronomy have been among the earliest pursuits of mankind, so they have been preposterously combined together, and connections frequently imagined between certain stars and particular plants. This is one of those instances, but too numerous in the history of the human mind, of theory, like an ignis fatuus, having led men astray, and made them pay

dear for a little real instruction, by bewildering them in endless errors and absurdities. And so hard is it to overcome prejudices, sanctified in a manner by antiquity, that this idea of a connexion between stars and plants is only just got rid of in the most enlightened parts of the world.

But to console ourselves under the contemplation of such humiliating instances of human weakness, let us turn our attention to the father of philosophy, at least of our philosophy, rising so superior to the darkness in which he lived, darting his penetrating glance through all nature, and establishing principles which a long course of ages of enquiry have but confirmed. With Aristotle begins the real history of science; and how much soever he may have erred on particular points, the greatness of his conceptions, and the justness of his ideas on the whole, entitle him to our high veneration, and we should correct his mistakes with awe. His labours in the investigation of the animal kingdom have laid the foundation

dation of the knowledge we now possess, and it cannot sufficiently be regretted that we have only an imperfect account of his discoveries.—Theophrastus, the worthy disciple of Aristotle, has given us the first scientific views of the vegetable and mineral kingdoms. His works are indeed short and imperfect sketches, but they are by the hand of a master. These two great men stand unrivalled as the only philosophical naturalists of antiquity of whom we have any satisfactory knowledge.

Several ages afterwards came Pliny, that laborious compiler, whose mind, too much occupied by a variety of pursuits, could properly cultivate none. He has transmitted to us, as far as he was able, all that was known of Natural History, or rather all that had been imagined, at the time in which he lived. Whether Dioscorides lived before or after him, and which borrowed from the other, the learned are not agreed, nor is it of much consequence to the reputation of either. Dioscorides has had perhaps no great injustice done him

him by a celebrated modern writer *, who styles him “a great compiler of receipts.” In fact his works are nothing else than a *materia medica*, in which he has enumerated all the natural bodies known at that time to have been used in medicine, with their imaginary virtues, but with so little judgment, that it were charitable to suppose he meant only to collect the opinions of others, without ever attempting to exercise that faculty. How he came to be called the father of botany is wonderful to me. It is less extraordinary that he should, after the revival of learning, have had innumerable commentators, because his short and imperfect descriptions would afford ample scope to those who imagined all human wisdom to be contained in the obscure works of men who had lived in the world a few ages before themselves.

That age of commentators we must now consider. I purposely pass over those times of darkness which followed the ruin of the Roman Empire, during which, if there

* Rousseau.

were any shadow of science in the world, it was among the Arabians, and they cultivated Natural History only as a branch of medicine. Those who wish to study this part of the history of botany, will find ample satisfaction in Haller's *Bibliotheca Botanica*, where they may also see an account of all the Greek and Roman authors who have at all touched on this branch of Natural History; and whom I have avoided mentioning, not only that I might keep within the bounds I had prescribed to myself, but because the labours of those writers do not appear to have contributed to the knowledge we now possess.

When learning began to raise its drooping head in the fifteenth century, those sciences of which most traces were found in the writings of the ancients began first to be cultivated. Botany was more especially attended to very early, as medicine, which, however it might have been degraded in the ages of barbarism, could never have been totally neglected, stood in immediate need of its assistance. The
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works of the ancients, and particularly those of Dioscorides, were then studied with the most pertinacious assiduity; remedies which this writer had recommended were deemed infallible, and virtues which he had attributed to any plant, indisputable. The chief difficulty in almost every case was to find out the plant he meant; and this difficulty becoming at length so great as to be absolutely insurmountable, his commentators were lost in the mazes of their own conjectures. It was happy for the credit of Dioscorides that this was the case, and that the world were so occupied by this kind of criticism, as seldom to have examined the truth of his assertions.

Of these commentators some few had great original merit in giving figures of the plants of which they treated, and those figures are many of them executed with such perfection as to excite our astonishment; they have rarely been excelled at any following period. The first of these is Brunfelsius, whose figures, although only wooden outlines, often express the plant intended

intended better than many fine modern engravings, and were evidently drawn by a first-rate painter. Matthiolus, the most celebrated of all the commentators on Dioscorides, has likewise given excellent figures of all the natural substances mentioned in his book; those of the large Venetian editions of this work are still the admiration of botanists, and make those editions much sought after by collectors.

The large figures of Fuchsius are no less celebrated, nor with less reason; although only outlines, they represent the plants extremely well.

The example of these authors was soon followed by others, who published figures of plants from their own observation; and ever since the middle of the sixteenth century the press throughout Europe has teemed with similar publications; certainly to the great advancement of botany, although the merit of these works has been very various.

For

For almost two centuries after the revival of letters in Europe, the attention of naturalists was chiefly confined to the vegetable creation ; and although since that time the animal and mineral kingdoms have received an eminent degree of cultivation, still botany has always kept its ground. The infinitely varied beauties of the vegetable tribe have, in every country, engaged some ingenuous minds in the contemplation of this branch of the great family of nature, and excited them to investigate the laws by which it is governed. Whether their labours have been crowned with the smile of princes, rewarded with worldly honours and emoluments, or only destined to enliven the scenes of rural retirement, to relieve the mind amid the busy pursuits of active life, or add new charms to social intercourse ; they have never failed to carry with them their own reward, in that sweet and innocent pleasure which rises under the steps of the botanist wherever he goes, in those sublime

lime and delightful ideas of the Author of nature to which such enquiries lead, and the complacency they always excite in the mind.

The institution of public botanic gardens is a memorable æra in the history of botany. The first of these was, I believe, at Padua in 1533*, where it still continues to make a tolerable figure, although now surpassed by several others, which have had more powerful protectors. The gardens of Florence, Pisa, Bologna and Leyden were soon after established, and all still exist. Nor must I forget to mention that we had at London a tolerable collection of plants in the garden of Gerarde, a catalogue of which, printed in 1596, exists in the British Museum, but is elsewhere rarely to be met with. The success of botanic gardens has pretty much kept pace with the commerce of the countries in which they were established; nor is this to be wondered at.

* The establishment of a *botanic* garden at Rome about the year 1450 seems not sufficiently authenticated. See Sabbati Hortus Romanus.

The intercourse of the Dutch with the East Indies, and their possession of the Cape, long gave their collections, in all the different branches of Natural History, a decided superiority over those of other nations. The English have now enriched their gardens far beyond any others by the supplies obtained from the East and West Indies, and especially from America.

I find myself obliged to pass over a number of naturalists who flourished from the middle to the end of the sixteenth century. Those whose works are the most known, and have been of the most service to the world, are Tragus, L. Fuchsius, Dodonæus and Dalechampius in Botany, Bellonius in Ornithology, and Rondeletius in Ichthyology. But there are a few great names which ought not to be so slightly mentioned; I must be allowed to enlarge a little on the merits of Gesner, Aldrovandus, Clusius and Cæsalpinus.

Conrad Gesner, the greatest naturalist the world had seen since Aristotle, was born at Zurich in 1516, and died of the plague

plague in 1565. Notwithstanding his constitution was feeble and sickly, and his life by no means a long one, he applied himself to the study of nature with such assiduity, that he not only made more new observations than had been made by any modern writer, but also first restored the science he cultivated to the dignity of philosophy, of which it had almost lost sight since the days of Aristotle and Theophrastus. Gesner cultivated medicine with equal success, proceeding always on the sure ground of observation and experience. His health, naturally weak, is said to have frequently suffered by the experiments he made on himself. But his infirmities did not deter him from taking frequent and laborious alpine journeys, any more than his very confined circumstances prevented his being at considerable, and at that time very uncommon, expences, in the advancement of his darling pursuits. He founded and supported a botanic garden, kept a painter and engraver in his service, had a very considerable library, and, according

to Haller, was the first who ever formed a museum of Natural History. But his greatest honour is his having first suggested the idea of a methodical arrangement of plants according to classes, orders and genera, from the different structure of the flowers; an idea which all true botanists since his time have pursued, and to which the very existence of botany as a science is owing.

Aldrovandus resembled Gesner in his indefatigable industry and zeal for the advancement of Natural History. Like him he devoted his life to travelling and study, and like him established a museum and undertook works whose immensity astonishes as much as their erudition. But he did not possess the systematic genius of Gesner, nor had he the prudence along with the liberality of his great contemporary. Although he had a fortune of his own, and was assisted by many of the rich and powerful of his time, he was reduced to indigence towards the end of life. He lived to the age of 80, dying in 1605. His
memory

memory has been always much honoured at Bologna. The great zoological work which he left imperfect, was finished after his death, and his museum laid the foundation of that which at present is one of the ornaments of that university. Many specimens still exist there marked with the venerable hand-writing of their first possessor*.

Neither had Clusius that genius for arrangement for which Gesner was remarkable.

* "The collection of the works on Natural History of this indefatigable man, consists of 13 volumes in folio; three of them upon birds, one upon insects, one upon animals which have no red blood, one upon fishes, three upon quadrupeds, one upon serpents, one upon monsters, one upon metals, and one upon trees.

"He is himself however the author of the first six volumes only; the rest having been compiled by various literati, pensioned by the Senate of Bologna, who laboured upon his plan, and with the materials which he had collected. This immense collection abounds with superfluous matter and things foreign to its object, and is at the same time deficient in choice and method; but in spite of such defects, Natural History will always have the highest obligations to Aldrovandus, and his

able. Botany is however very much indebted to him for the publication of a vast number of new plants, with excellent figures which atone for the imperfections of his descriptions. His amiable disposition, says Haller, procured him a great number of friends, whose discoveries enriched his own works. He always acknowledged their favours, and gave to every body their due praise. A number of the plants discovered by Gesner were first published

work must always be considered as the dunghill of Ennius, where Virgil went to seek for pearls.

“ It is common with writers to make Aldrovandus die of poverty in the hospital. Certainly the long journeys he undertook for the sake of Natural History, and the considerable sums paid by him to the most celebrated artists, in order to procure exact figures of different productions of the three kingdoms of nature, so far ruined his fortune, that though supported in these expences by some sovereigns zealous for the advancement of science, as well as by the Senate of Bologna, he found himself towards the end of life reduced to a kind of indigence. After his death he was honoured with a magnificent funeral, which is sufficient to refute the story of his extreme beggary; neither is it credible that
those

lished by Clusius. This illustrious botanist died in 1609, at the great age of 84. He was professor of botany at Leyden, where a palm tree (*Rhapis flabelliformis*, of the Hortus Kewensis) planted by him, still exists in great perfection.

I am now to speak of Cæsalpinus; but if I should enter into a full discussion of his character and merits, it would lead me a great deal too far. His ardent attachment to Aristotle led him into the depths of me-

those sovereigns who had contributed to his undertaking, or the Senate of his own country, to which he had left his rich museum as a legacy, could have let him die of hunger. The anonymous author of the *Mélanges d'Histoire Naturelle*, printed at Lyons in 1763, adopting this fable, and saying that Urban VIII. made an epigram in honour of Aldrovandus and of his beautiful plates, which finishes with this elegant distich,

*Obstupet ipsa simul rerum fecunda creatrix,
Et cupit esse suum quod videt artis opus,*

seems to wish to imply that this Pope was contented with rewarding the labours of the philosopher with verses only. But it is a certain fact that Urban VIII. did not obtain the pontificate till eighteen years after the death of Aldrovandus." *Fontana.*

taphysics, and into many errors relating to the nature of man, and the first cause of all things, which the dogmas of the court of Rome where he lived were not likely to correct, in a philosophical mind like his. He has left evident proofs of his knowing the circulation of the blood at least through the lungs, and the services he has rendered to botany entitle him to be ranked among its most able promoters. I need not enter into the particulars of his method, which is chiefly founded on the fruit. He has made some mistakes, which Haller has taken care to point out; but it must not be forgotten that Cæsalpinus has thrown more light on the structure and affinities of vegetables than any one before his time, and has distinctly mentioned the sexes of plants. He died in 1603.

While these great men were flourishing on the continent, botany began to be attended to in our own country. Turner published his Herbal in 1551; soon after Lyte gave a translation of Dodonæus; and in 1597 was printed the first edition of
Gerarde's

Gerarde's Herbal. It is sufficient that I mention the names of these authors. Lobel, who began to publish in London in 1570, and who is the author of many good observations, has been often mistaken for an Englishman; but although he spent the greater part of his life here, he was born in Flanders.

It would be unpardonable if I were to finish this period of the history of our science without mentioning Fabius Columna, who first gave copper plates of plants; and those of an almost unrivalled degree of accuracy, drawn and engraved by his own hand. In his *Phytobasanos*, published at Naples in 1592, and again at Florence in 1744, he has taken infinite pains, and shewn great sagacity, in determining some plants of the ancients, and has detected innumerable errors in Pliny and other authors. His *Ecphrasis* published several years afterwards is a larger work, and contains a large number of new plants, distinguished and figured with the greatest accuracy. He is likewise the author of a curious and

learned work on the Purpura of the ancients. All these books, especially the first, are very rare. Columna, an able critic himself, was criticised in his turn by one far inferior, Aldinus in his Hortus Farnesianus, printed at Rome 1625; a work in which however there are some good figures of rare plants, and which is not commonly to be met with.

The institution of the academy of the Lyncei at Rome in 1603 deserves to be remarked, as that society was the first of the kind, and has been in some measure the model of all the present literary societies in Europe. Its chief promoter and perpetual president was Frederick Caesius, a young Roman nobleman of great science. Among the names of those who composed it we find Fabius Columna and the great Galileo, a circumstance perhaps more likely to immortalize its memory than the medals which were struck upon its establishment. This institution died with its noble founder in 1630.

The number of authors who had written

on plants without any system or method in the sixteenth century, and the confusion of names which had been introduced, seemed to render it at length necessary for the preservation of the science that some great systematic genius should undertake to digest the confused mass, and, profiting of the hints of Gesner and Cæsalpinus, reduce into order the vast materials, with which botany was in a manner overwhelmed, rather than enriched. But this event, so much to be desired, was not yet to take place in its full extent. An eminent service was however rendered to botany by the two illustrious brothers John and Caspar Bauhin, with whom I shall close the history of the sixteenth century, and enter on that of the seventeenth.

John Bauhin was in a great measure formed as a botanist under Gesner; but not having a turn for system, he did not in that respect learn much from his great teacher. He devoted a life of more than 70 years to a critical investigation of all that had been written before him, and
made

made many valuable observations as well as many original discoveries. But he opened no new path in botany. His labours were conducted on the same plan as those of his predecessors. The fruit of his studies is nothing less than an Universal History of Plants, which being left in MS. at his death in 1613, was not published till 1650, when it appeared in three volumes folio. Like all posthumous works it has defects, which probably it would not have had if published by its author. It is a monument of labour and erudition, and contains so much information and so many elucidations of preceding authors, as to be still in great estimation, notwithstanding its want of order and the rudeness of the figures.— This work paved the way for Caspar Bauhin in the much more important and original one which he undertook and happily perfected, the publication of which forms one of the most remarkable æras in botany, and which was first printed in 1623, under the title of *Pinax Theatri Botanici*. This was meant, as its name imports, as an

an index to all the botanical knowledge then in the world, and its author exultingly styles it the labour of 40 years. In this work about 6000 plants are arranged in twelve books, with some slight traces of system, and each plant is distinguished by a kind of descriptive name, under which are placed the names given it by every preceding author. Ray has very justly remarked, that besides errors and repetitions incident to the most wary in so vast an undertaking, Bauhin's Pinax contains some hundreds of plants there mentioned as species, which have since been found to be only varieties; and if this was true in the time of Ray, it is much more so at present. Notwithstanding such imperfections, this work has been found so useful, and indeed so necessary, that it continued the general dictionary of botanists, till superseded by the publications of Tournefort and Linnæus, and is even now the only resource of those who wish to study the authors whose works are prior to it. But this is not all which the active mind
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of Caspar Bauhin undertook. He published an excellent edition of Matthioli with many additions; and has illustrated about 600 new or heretofore mistaken plants in his Prodomus, published first in 1620, and afterwards with an improved edition of his Pinax in 1671, which is that most in use. He likewise meditated a complete history of all the plants mentioned in his Pinax, and finished, as it is said, three books, of which the first only was published by his son in 1658, with figures. It contains grasses and some liliaceous plants. Besides all these botanical labours, Caspar Bauhin practised medicine with great success, and was so eminently skilled in anatomy as to have been stiled in his time the prince of anatomists. He died in 1624, aged 64, being about 20 years younger than his brother. I have seen a great part of his herbarium at Basil, in the hands of Mr. De Lachenal, professor of botany there. This herbarium is inestimable on account of the difficulty of determining many of Bauhin's plants by his descriptions

descriptions alone, and its worthy possessor devotes it to the purposes of public utility, to which indeed all treasures of science ought to be devoted.

We must now make a pause in the history of botany. Notwithstanding the labours of the Bauhins seemed to promise new vigour to this lovely science, it languished for nearly half a century after the time in which they lived. Not that there were no botanical writers, nor any collectors of plants in all that period, for there were a considerable number of both, as well as several writers on the materia medica. Hernandez was sent to South America by Philip II. at a vast expence, but the fruit of his labours is one of the worst books in botany. The Italians puzzled themselves and their readers about opobalsamum and the ingredients of the mithridate; and a number of inferior writers appeared in different parts of Europe, especially in Germany, whose names and merits I might be excused mentioning, even

if on this occasion I had much more time allowed me.

I must only except Jungius, who in his *Doxoscopiæ Physicæ Minores* has given great proofs of botanical sagacity, and has thrown out some hints, of which following botanists, and among them Linnæus himself, have profited with great advantage. Jungius died in 1657.

Our countryman Parkinson was also an author of great originality and observation, much superior in this respect to Gerarde, or his commentator Johnson, although his figures are inferior to theirs.

I shall profit of this interval to review the progress of zoology from the middle of the sixteenth to the end of the seventeenth century.

It is remarkable that a part of natural history, so evidently the most important and the most interesting to man, who is himself at the head of the animal creation, should have lain so long uncultivated. From the time of Aristotle to Gesner
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and Aldrovandus, few or no improvements were made in the knowledge of animals, nor with respect to classification was any alteration attempted till the time of Ray. The Aristotelian division of animals into viviparous and oviparous is well known. In the former class were arranged all quadrupeds, and in the latter birds, fishes, and insects. Aristotle was himself sensible that this system must be taken with some latitude, there being several quadrupeds, as lizards, which are not viviparous, and some insects and fishes viviparous, although not quadrupeds. By insects he and all other naturalists down to Linnæus understood such of the smaller kinds of animals as have the body divided into segments, so that many worms and even fishes were included in this division.

Gesner arranged his voluminous history of animals upon the principles of Aristotle, separating the oviparous from the viviparous quadrupeds; and Aldrovandus collected all that others had written, indeed without sufficient discrimination of truth
from

from fiction, and disposed it much in the same order. With respect to Ornithology, Gefner cultivated that science with peculiar success, and is the author of many very valuable observations. Aldrovandus copied him in many things, and Johnston is hardly worth mentioning, as he has done little else than copy both. Besides what the authors above mentioned have given us relating to fishes, that branch of natural history was ably handled by Paul Jovius, an Italian physician of great taste and learning in the beginning of the sixteenth century; afterwards by the accurate Bellonius, who wrote also on birds; by Salvianus in his superb book on aquatic animals, printed at Rome in 1554; and by Rondeletius, professor at Montpellier, who published the same year. Insects were also particularly treated of in a work the joint labour of several able men, among whom was the indefatigable Gefner; this book was published by Dr. Mouffet, an English physician, in 1634.

This was the state of Zoology when our

own immortal Harvey first dared to controvert one of the doctrines of Aristotle, which, although really unworthy of so great a philosopher, nobody had hitherto opposed, I mean that of equivocal generation. The metaphysical quibbles which had so long disgraced the schools, began now to give way to a spirit of enquiry and observation; but not in the schools themselves, for from thence light seldom springs. The proposition of Harvey, "*omnia ex ovo*," was not received without opposition; but this was forgotten in the much more furious opposition given to his other more important and interesting doctrine, of the circulation of the blood. No sooner was this published than a crowd of adversaries beset him. After in vain endeavouring to refute his opinion, they had recourse to the common subterfuge of denying its originality; taking upon themselves the greater reproach, of having been blind to the evidences already existing of so indisputable a truth, rather than allow their illustrious contemporary any merit in the discovery.

With Harvey begins what may be called the physiological period of Natural History. His hypothesis of generation was confirmed by the experiments of Redi and Malpighi, two very philosophical naturalists, who have disencumbered science from many prejudices, and thrown much light on some of the most abstruse parts of physiology. The experiments of Redi to disprove equivocal generation, are truly admirable; and Malpighi's investigations, relating to the anatomy and transformation of silkworms, and the development of the chick in the egg, are too celebrated to need any fresh eulogium. About the middle of the seventeenth century a new and very interesting proposition in physiology was started, that of the sexes of plants, the honour of which is given to our countryman Sir Thomas Millington. It is to be wished however that he had written something himself upon the subject, or that we knew whether the idea were really originally his own. Nearly about the same time the discovery of the lymphatic vessels

in animals was made, either by Rudbeck or Thomas Bartholin, or rather by both at once. All which I think justifies me in calling the period of which I am speaking, a physiological age. In it was laid the foundation of almost every doctrine which has since been cultivated and enlarged upon, and on which all following medical and physiological systems have been built.

It is no wonder that systematic Zoology should derive advantage from all these discoveries. Towards the end of the last century appeared two great naturalists, amply qualified to profit by them, and to whom the science is infinitely indebted, our countrymen Willughby and Ray. These illustrious friends laboured together with uncommon ardour in the study of nature, and left scarcely any of her tribes unexplored. But death, which so often disappoints the fairest hopes, cut off the former in the prime of life, before he had digested the materials to the acquisition of which he had devoted his youth; and they might all have been lost to the world and

his name have perished with them, but for the faithful friendship and truly scientific ardour of Ray. So close was the intercourse between these two naturalists, that it is not easy to assign each his due share of merit. Indeed Ray has been so partial to the fame of his departed friend, and has cherished his memory with such affectionate care, that we are in danger of attributing too much to Mr. Willughby, and too little to himself. Certainly however it is by no means a fair statement of the case to say with Dr. Derham, that Mr. Willughby had taken the animal kingdom for his task, as Mr. Ray had the vegetable one. The Ornithology and Ichthyology sufficiently shew that Ray was not a mere editor of those noble works, and the Synopses Avium & Piscium, published some time after, in which he has made many improvements, and some important changes as to arrangement, prove with how much attention he had studied those two branches of Zoology. I need not add that the Synopsis of Quadrupeds

is,

is, as to method, entirely his own, although Willughby is there often quoted for many excellent observations; and the same may be said of the *Historia Insectorum*, published in 1710, after the death of Ray. All these works are excellent in their kind, admirably methodized, and exhibit such proofs of accurate observation, such a candid love of truth, and such penetration in discovering it, as must ever rank their authors among the first and most philosophical naturalists.

Ray, being dissatisfied with Aristotle's classification of animals, was the inventor of a new one, founded on the structure of the heart. The Harveian experiments and doctrine of the circulation had called the peculiar attention of philosophers to every organ which has a share in that phenomenon, and to this cause probably we owe the method of Ray. Taking therefore the division of animals into Sanguinea and Exanguia, which was a very ancient one, he subdivides the first class into such as are furnished with lungs and such as breathe

by gills; and the former of these he again separates into those which have an heart with two ventricles, and those whose heart has only a single ventricle. The latter division contains Reptiles, the former viviparous Quadrupeds, Whales and Birds. The Animalia branchiis respirantia include all Fishes properly so called, the Whale kind and all the Exanguia being of course excluded. The Animalia Exanguia are divided into greater and lesser. The latter division contains Insects; the former is again subdivided into three genera, the first of which includes the Mollia, or Mollusca, as Cuttle-fish and Polypi; the second Crustacea, as Crabs and Lobsters, which are properly Insects; and the third Testacea, or Shell-fish. This system, although liable to a great many objections, which I shall not now stay to enumerate, is deserving in many respects of great praise: its author has shewn eminent skill in the characters by which he has chosen to discriminate the subordinate divisions, and in short the Linnæan system of Quadrupeds

drupeds is little more than a reformation of that of Ray. I shall soon speak of the botanical merit of this great man ; but before we take leave of this period of Zoology, it may be expected I should say something of Leeuwenhoek, and his theory of generation, which has made so much noise ; nor may it be useless to mention him, if only as a *memento* to future theorists. What a pity it is, that so excellent an observer, to whom the world is indebted for so much solid physiological information, should have produced an hypothesis, whose celebrity seems but to have hastened its refutation, and consigned it to more absolute neglect ! The spermatic worms of Leeuwenhoek may perhaps be the jest of philosophers many ages to come, while others shall profit of his genuine discoveries, without knowing to whom they are obliged.

Let us now take a general view of the state of Natural History at the end of the last century.

In England the flattering aspect which this science had worn under the auspices

of Charles I. was blasted by the turbulent times which followed ; but in the peaceful days of Charles II. natural history, as well as all the different branches of philosophy, received a degree of cultivation and advancement hitherto unknown in this country ; and this led on to the golden age of science in England, which was crowned by the possession of a Newton.

The Royal Society, which, from a small beginning at Oxford about the year 1645, made rapid advances when removed to the metropolis, was established under the protection of the king in 1662, very soon after his restoration. This learned body bestowed great attention from the beginning, as they have ever since done, upon the physiological part of natural history. The names of Boyle, Evelyn, Hook and Needham, are among the first members of this society ; and how much they have laboured in the advancement of natural science is well known. Mr. Willughby was one of the original fellows of the Royal Society, although his friend Ray was not admitted

admitted till the year 1667. Dr. Lister, the great conchologist, was very early associated with it, as well as that admirable vegetable physiologist Dr. Grew.

Nor was France behind-hand with England in attention to the sciences, and among the rest natural history. Henry IV. that great name which science delights in joining with humanity to bless, had endeavoured long ago to promote literature and useful knowledge throughout his dominions. Among other institutions the botanic gardens of Paris and Montpellier are owing to his munificence. But his untimely death, and the subsequent disturbances, for a while put a stop to all farther cultivation of the arts of peace. About twenty years afterwards, by the indefatigable perseverance of De la Brosse, superintendant of the Paris garden, the Cardinal de Richlieu was induced to grant it his protection; but this garden first rose to any considerable degree of eminence towards the end of the last century under
Louis

Louis XIV. This munificent prince encouraged learning with that splendid liberality which distinguished all his actions. For the purpose of promoting botany, and enriching the royal garden, the illustrious Tournefort was sent to the Levant, and the accurate and indefatigable Plumier made three voyages to America, and died as he was about undertaking a fourth. An Academy of Sciences was instituted at Paris in 1666, and another some years after at Montpellier, very similar to the Royal Society of London, with which the greatest men in Europe have always been proud to be associated.

Many similar institutions were set on foot throughout Europe, as the Imperial Academy Naturæ Curiosorum, begun in 1652. A number of botanic gardens were also established in Germany; but Linnæus has truly observed that they have never been rich in exotic plants, on account of the small intercourse of that country with the Indies; whereas the gardens of Hol-
land

land were at this time overflowing with riches from the most distant parts of the globe.

The Amsterdam garden under the care of the Commelins was now one of the first in Europe, and that of Leyden was rendered celebrated by the catalogue published by Herman. Holland had moreover the glory of producing at this time that most sumptuous and excellent work, the Hortus Malabaricus; by which a new world was in a manner laid open to the botanists of Europe, and from which they learned with surprize, that the knowledge of plants had made almost as much progress in the remote regions of Asia, as in their own part of the world.

But the study of nature was no where making such an uniformly steady progress as in Sweden. At Upsal, under the auspices of the great Rudbeck, was laid the foundation of what Mr. Stillingfleet has justly called an unrivalled school of natural history, and which was destined afterwards to give laws to the rest of the world. Rarely
has

has such a variety of profound and extensive learning been united as in Rudbeck. I have already mentioned his anatomical merit in discovering the lymphatics. In antiquities, especially those of the northern nations, and in the learned languages, his knowledge was unbounded*. In botany he had erected to himself what might reasonably have been thought a “monumen-

* “The most curious, singular, and in every respect most extravagant work of this extraordinary man is his *Atlantica, sive Manheim, vera Japheti posterorum sedes ac patria*, printed in 1679, 1689, and 1698, in three folio volumes. Another volume was intended to have been published, which remains in manuscript, and in its place is given as a fourth volume, an Atlas of 43 maps, with two chronological tables. This rare work is full of immense erudition; but, as usual in the North, this erudition, poured forth by wholesale, without discrimination or taste, tends to confound and overwhelm the reader rather than to inform him. The author maintains the strangest and most unbounded paradoxes. He pretends that Sweden, his own country, was the abode of the ancient Pagan deities, and of our first parents, the terrestrial paradise, the true Atlantis of Plato; and that it was the origin of the English, the Danes, the Greeks, the Romans, and of all the rest of the world.”
Fontana.

tum ære perennius," in one of the greatest undertakings of the kind, a collection of fine wooden cuts of all the plants then known. They were to have been arranged and named according to Bauhin's *Pinax*, in 12 large volumes folio. But two volumes were scarcely printed, when in 1702 a dreadful fire reduced almost all Upsal to ashes, and with it the work of Rudbeck, and many thousand wooden blocks already cut, besides almost all the materials of an history of Lapland composed by his son, who indeed had a principal hand in the great work of which I am speaking. It can scarcely be thought an impeachment of the venerable old man's philosophy, that so cruel a disappointment soon brought him with sorrow to the grave.

All that remains of this work are a few copies of the second volume, and three only of the first, one of which is in the Sherardian library at Oxford. Linnæus was possessed of about 120 of the wooden blocks of this first volume, as well as 8 or 10 unpublished blocks belonging to some intended

intended one; all which came with his collection into my hands: they are for the most part admirable figures of grasses*.

Having been now insensibly led back to Botany, I shall take a comprehensive view of the systematic æra of that science, when so many new methods of classification were invented, most of which were strenuously supported by their respective authors, who little thought that in the space of half a century, oblivion would nearly level all distinctions between them.

The first who revived the idea of a classical arrangement of plants, since the time of Cæsalpinus, was Morison, who has been justly censured for neglecting to acknowledge how much he owed to his ingenious predecessor, and who has in his turn received similar treatment from his followers. His method was founded chiefly on the fruit, to which, as well as the external habits of plants, he paid too much regard, and too little to the other parts of fructifi-

* Published under the title of *Reliquiæ Rudbeckianæ*, folio, 1789.

cation.

cation. The only work classed according to the method of Morison is his own *Historia Universalis Plantarum*, an useful compilation, which is daily used as a book of reference, by those who never think of his system.

But the three principal systematic authors were Ray, Tournefort and Rivinus, between whom was much warm controversy on the subject; and it must have been an interesting matter indeed that could so agitate the candid peaceable spirits of Ray and Tournefort. Of Ray it may be said, that his method was the most abstruse and scientific, while that of Rivinus was at first sight more simple, but liable to as great difficulties in the execution. The former was principally founded on the fruit, the latter on the corolla, and in both were the other parts of fructification too much neglected. The system of Tournefort, which was likewise formed chiefly upon the corolla, was undoubtedly far superior to all the rest then extant; yet I doubt whether that alone would have procured its author
his

his extensive reputation, had he not investigated and discriminated the *genera* of plants in so masterly a manner, that this alone is sufficient to rank him above all preceding botanists. It is true he did not invent a mode of systematically defining these genera by words; this was reserved for Linnaeus: but it has been well observed by Monsieur Delamarck, that Tournefort was no less sensible of the distinctions of his genera, and he has caused them to be figured in so able a manner that they cannot be mistaken.

This great botanist, chiefly unfortunate in having had some injudicious advocates, is the glory of the French nation. His countrymen are with reason proud of him, and his merits as a botanist and a traveller are so well known, that no commendation of mine can add to his fame. Yet I must not omit to do justice to his successor Vailant, whose merit I think is hardly sufficiently known. In profiting of the indulgence granted me when at Paris of consulting the Herbariums of these two eminent

nent botanists, I was astonished at the instances of profound knowledge and acuteness of judgment which I met with in that of Vaillant, both with respect to the genera, species, and synonyma of plants; whereas it is well known that Tournefort was less solicitous about the scientific distinctions of species. Vaillant is also one of the first who was well acquainted with the sexes of plants. His academical oration on that subject is full of good observations, though not without some errors. In this work he laughs without reserve at Leeuwenhoek's peculiar theory of generation, and speaks rather too disrespectfully of Tournefort: for this he has never been forgiven.

There were at this time several botanical systems invented besides those above mentioned; but few being remarkable for originality or use, I cannot dwell long upon them. Herman's was one of the best. It was entirely founded on the fruit, and not very different from those of Ray and Morison. Boerhaave's had great merit, in

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being founded more or less on all the parts of fructification. The method of Christopher Knaut is an alteration of that of Ray, without any improvement. The paradoxical Christian Knaut, who thought the essence of a flower consisted in its corolla, was never very famous, and would now probably make no profelytes at all.

A singular system was invented by Professor Magnol of Montpellier, founded on the calyx, to which Linnæus was very partial, and he even formed a similar method of classification himself: happily, however, this was not the only one he ever invented.

Nor was this æra of botany merely a systematic one. Linnæus has not scrupled to assert, that within the space of twenty years, at the end of the last century, twice as many plants were discovered as had been made known by the joint labours of all preceding botanists. Besides those which were collected by Tournefort, Plumier and Ray, a noble collection was brought from Jamaica by Dr. Sloane, afterwards

terwards Sir Hans, of which the history in two volumes folio is well known. Mr. Sherard consul at Smyrna, who cultivated botany with princely munificence and with the ardour and discernment of a true philosopher, has been the means of making known a very great number of plants. His vast herbarium and library are now among the literary treasures of Oxford. The indefatigable Plukenet procured and published an immense number from all parts of the world, many of them very rare. His book is in every body's hands, and it would be superfluous here to say any thing of its utility. Petiver was no less persevering in making collections, not only of plants, but of all kinds of natural objects. His works are of a very peculiar character, and exhibit more zeal than genius or accuracy. His rough criticisms of his contemporary Plukenet have hurt nobody but their author. The acquisitions of Dr. Herman in Ceylon were very considerable. They lay a while dormant, only to appear with greater celebrity from the

pen of Linnæus. In so brilliant a period of the history of this science I am obliged to pass over many less illustrious, although great names; and shall only mention Rumphius, whose ardour was not to be damped even by the greatest misfortune which can befall a naturalist, the loss of sight. The rich treasures of Amboina were made known to us by this laborious man. His book on shells is in high estimation; and his *Herbarium Amboinense* might vie with the *Hortus Malabaricus*, if all concerned in the publication of it had performed their parts as well as he has done his: but the figures are by no means comparable to those of that stupendous work. The courage of Rumphius in pursuing natural history after he had lost his sight, reminds me of a similar instance, I believe very little known, of a Provençal physician named Reboul, who undertook a manuscript history of plants in several large folio volumes, and, becoming blind, actually completed many of the unfinished chapters with his own hand after that accident.

This curious manuscript was shewn me in the public library at Parma.

While Botany was making this great progress, Entomology began to be cultivated with an assiduity, which was amply repaid by the curious and astonishing facts it brought to light. The notion of equivocal generation having been refuted by Harvey, Redi and Malpighi, the propagation and metamorphoses of insects became an interesting object of enquiry with several able men, among the first of whom were Goedart and Swammerdam. The discoveries of Goedart were received with laudable caution by his contemporaries, especially what relates to the history of Ichneumonides; but following observers have confirmed the accuracy of his relations. The works of Swammerdam are full of curious information, and will sufficiently reward those whose patience is not to be exhausted by his tedious heavy style. Nor must I forget Madam Merian, whose excellent work on the Surinam Insects, one of the most splendid in natural history,

is a monument of female perseverance and enthusiasm.

Other admirers of nature have turned their attention to shells and marine productions; and the facility with which these bodies are preserved in cabinets, has made the collecting them very general. A few authors had written on shells about the beginning of the last century, as Aldrovandus, Columna, Imperati, &c. but about the end of the century two very eminent writers were particularly distinguished in Conchology, Bonanni and Lister. Their works are in daily use. In the different publications of the latter are many curious anatomical observations, and Bonanni has treated the formation of shells in a very philosophical manner. Some interesting hints on the same subject are to be found in Steno's "De Solido intra Solidum Dissertationis Prodromus," printed at Florence in 1669.

Of all the parts of Natural History, Mineralogy for a long time made the slowest progress. From the time of Theophrastus

to the end of the seventeenth century few improvements were made in the knowledge of Fossils. What little was written in all that time contained only repetitions of old erroneous superstitious opinions. Even at the period of which I am speaking, a striking idea of the darkness of this science may be formed, from Tournefort's having maintained the vegetation of stones, and Lister's having positively asserted that all extraneous fossils, as petrified shells, &c. are only *lusus naturæ*, and never were the real shells they represent. Afterwards Mineralogy was cultivated with a little more care, but still on wrong principles, the external figure of fossils being principally attended to, and not their component parts; nor was it till very lately that the science was established on its true foundation, that of chemical analysis.

For about fifteen years after the beginning of the present century nothing very considerable was printed in botany. But the year 1718 is remarkable for the publication of Rupprius's excellent *Flora Je-*

nenfis, and the following for the appearance of Scheuchzer's inimitable *Agrostographia* and Dillenius's *Flora Giffensis*. Ruppis being cut off early in life, disappointed the hopes which were formed of him. Dillenius is one of the most illustrious names in botany; not so much indeed for systematic or physiological merit, as for accuracy of observation and judicious criticism. About this time also flourished Pontedera at Padua, who although a great Tournefortian, and strangely prejudiced against the sexes of plants, was a scientific botanist, and is very liberally praised by Linnæus, against whom he is said nevertheless to have written something, which was never published*.

The

* This criticism has however been lately published in a posthumous work entitled *Julii Pontedera Epistola ac Dissertationes*, printed at Padoua in 1791 in 2 volumes 4to.—On the subject in question the editor and commentator of the work, Mr. Bonati, keeper of the library at Padoua, in his elegant preface has the following remark: *Enimvero cum in quedam horumce voluminum loca lector incidit, sentiet oratorias excursiones in Linnaeum tamquam*

The removal of Dillenius to England, who published here his excellent edition of Ray's *Synopsis Stirpium Britannicarum* in 1724; the assistance and encouragement given to the science by those two distinguished brothers William and James Sherard, as well as by Sir Hans Sloane, seemed to promise the establishment of the botanic sceptre in this country; especially as the insufficiency of Tournefort's system became every day more obvious, and Boer-

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quam Botanicæ perturbatorem ac hostem Catilinariis fere aut Philippicis Orationibus æquiparari; ac sibi videbitur Scholasticum aliquem Galileo aut Cartesio obtræctantem audire.

Moreover, although the Linnæan System be wonderfully ingenious as well as new, it neither is nor can be exempt from defects and inconveniences, which will never be avoided in any system that can be imagined. The celebrated Mr. De Lamarck, after having given it the most splendid eulogium in his fine preliminary discourse to the Botany of the *Encyclopédie Méthodique*, concludes thus: "It is not however to be denied, that this system, which does so much honour to the sagacity and ingenuity of its illustrious author, is not so happy in its application to practice as it seemed to promise, and as it might be wished; since it not only breaks a

considerable

haave was too much occupied by medicine, to devote any considerable share of his powers to any other pursuit. The physic garden at Chelsea was in a very flourishing state under the care of the celebrated Miller, and that of Mr. Sherard at Eltham contained one of the choicest collections in Europe. But botanists were almost at a stand about arrangement. All the different systems which had been proposed, however specious in university lectures,

considerable number of natural affinities, separating plants which the most resemble each other, and dividing families which are the most generally acknowledged, but its manifest insufficiency in a great number of cases, deprives it of the principal and even sole merit of an artificial system, which consists in helping us easily and certainly to make out the name of any plant that we want to ascertain."

But what does this mean? That a method perfect in all its parts has never yet been, nor ever will be. See what Pontedera himself says in the work above quoted, vol. ii. diff. 11. *that there is no perfect botanical system.* And where is there any thing human which is complete and faultless? *He that has fewest faults, says Horace, is the best man; and so it is with scientific systems."*

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having been found very insufficient for the purposes of practical botany, the science was again in danger of relapsing into anarchy and confusion, and botanists were almost overwhelmed with the riches which daily flowed in upon them.

In this state of things a new turn was given to the science of botany, and indeed to all natural history, by the publication of the *Systema Naturæ* and *Fundamenta Botanica* of Linnæus in 1735. Nor were the learned world determined how they should receive these extraordinary productions, when in 1737 the same author, without any other support than his own transcendent merit, fixed the attention of all Europe, by his *Critica Botanica*, *Genera Plantarum*, *Hortus Cliffortianus*, *Flora Lapponica* and *Methodus Sexualis*; five works, the produce of one year, each of which would alone have been sufficient to have immortalized its author, and in the composition of which a man's whole life might have been thought usefully employed!

Having

Having by a number of original observations, added to those of former writers, demonstrated the sexes of plants, and consequently the importance of their stamina and pistilla; Linnæus founded his sexual system on the differences in number, situation and proportion of these organs: a system which, although professedly merely *artificial*, is really in many respects more agreeable to nature than many which had preceded it, and which, for facility and universality, has a decided superiority over all hitherto invented. But this was only a part of the praise of this rising genius. Having new modelled and systematically defined all the known genera of plants, he endeavoured in like manner to define the species upon philosophical principles; a thing hitherto unknown, or at least but faintly attempted by some old botanists. Of the success of Linnæus in this undertaking, as well as his judgment and accuracy in collecting synonyms, the Hortus Cliffortianus and Flora Lapponica afford sufficient proofs. In them may be seen the dawn-

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ing of those talents which afterwards produced the *Species Plantarum*; while the didactic precision and critical acuteness of the *Fundamenta* and *Critica*, gave a foretaste of that perfection which was hereafter to appear in the *Philosophia Botanica*.

Nor were the abilities of Linnæus less conspicuous in his distribution of the animal kingdom. Of this the first edition of the *Systema Naturæ* was but a sketch, which was afterwards corrected and much enlarged. It is unnecessary here to enter upon the particulars of his system, which has been familiar to all naturalists for these fifty years. I shall only say, that what in my opinion are the best parts of it, the classes of birds and insects, were altogether original. For the detection of the essential character of the latter in their antennæ, we are entirely obliged to Linnæus; and his subordinate distinctions were not only the first, but long experience has proved them the best, that have ever been invented.

His

His arrangement of fossils, the best at the time it was first published, is now generally neglected. Although in some instances founded on chemical principles, in others the most obvious laws of chemistry were sacrificed to external figure; and the science having been of late years so totally reformed, it is no wonder that Linnæus's *Regnum Lapideum* is become obsolete.

This illustrious man, returning in 1739 to Sweden his native country, there fixed the throne of Natural History. Soon after his arrival he helped to lay the foundation of the Academy of Sciences at Stockholm, of which he was the first president. His distinguished merit and amiable manners procured him the favour of the rich and powerful, as well as the attention and admiration of the scientific; and his medical and botanical lectures at Upsal soon attracted a number of students from all parts of the world, and exalted that university to a degree of fame hitherto unknown.

It is true, he did not escape the attacks of envy and jealousy; nor can any exalted character,

character, however inoffensive and prudent, hope to escape them. But they never put him so much off his guard as to waste his time in controversy, nor would he give his adversaries immortality, by transmitting their names to posterity with his own. I shall on the present occasion follow his example; nor drag from obscurity works long since forgotten, or authors who never were noticed. I cannot but observe, however, that professor Siegesbeck, notwithstanding his intemperate zeal in attacking the sexes of plants and Linnæus's system with all the arms he could muster, both sacred and profane, was by no means the most contemptible of all the authors on that side the question. He has been unfortunate enough to be always held forth as the botanic Zoilus; but I think there have been some critics, even in our own country, who for futility, ignorance and malevolence, would have much greater claims to that title, if they were of consequence enough to claim any title at all.

We must now consider some of the most
eminent

eminent naturalists who were contemporaries with Linnæus in the beginning of his literary career, and whose labours tended essentially to the advancement of the science. It would be endless to enumerate all who have cultivated or written upon natural history during this golden age; we can only notice a few of the most distinguished.

His most intimate companions at this time were Artedi and Gronovius; the former of whom has in his Ichthyology discovered such talents for natural history, that his premature death cannot be sufficiently regretted. Gronovius has contributed in various ways to the advancement of the science. His *Flora Virginica* and his zoological works are constructed upon Linnæan principles. He was always in amicable correspondence with Linnæus; as constant in the offices of friendship as deaf to the impulses of envy and jealousy. It was Gronovius who had the honour of naming the Linnæa after his illustrious friend.

One of the greatest and most extensive geniuses of this or any age was Haller, that great physiologist and unwearied observer, who, though at first the friend, afterwards became the rival, and the only respectable rival, of Linnæus, compared with whom all his other critics sink into nothing. What a pity it is these illustrious men were not always friends! What a pity the memory of Haller should have been disgraced by the publication of those confidential letters, the revival of which one would have thought sufficient to disarm the most inveterate mind!

———“Tantæne animis cœlestibus iræ?”

I must however rescue the name of Haller as much as possible from this foul stain. On a careful enquiry among those who alone could satisfy me on the subject, I am inclined to think his powers of body and mind were so enfeebled that he may be said to have been not himself at the time these letters were published, and probably never revised them. Else can

we suppose a character like his would so grossly have violated, not only the confidence of friendship, but even the laws of paternal affection? for in that collection are letters of one of his sons, then no more, which no father ought to have made public. Perhaps the temptation of producing such testimonies of his own celebrity was, in the weakness of old age, too flattering to that vanity from which Haller is acknowledged not to have been free. Neither was Linnæus himself without his share of it; and if vanity were never found but with such pretensions, who would not almost forget that it were a weakness?

I cannot attempt to enumerate all the works of Haller, much less to display their merits. His history of the Switzerland plants is one of the most excellent and complete Floras the world ever saw, and is only deprived of the general applause it deserves, by the author's unconquerable dislike to the Linnæan classification and nomenclature, by which his work is rendered extremely unfit for common use.

His

His *Physiology*, *Bibliotheca Anatomica* and *Bibliotheca Botanica*, are among the most stupendous monuments of human knowledge as well as of human labour. They defy imitation, and strike criticism dumb.

Another distinguished name also claims our attention, that of Reaumur. I know none more worthy to stand next to Haller. Besides the various discoveries of this great French naturalist which were of immediate use in improving the arts and manufactures of his own country, the philosophical world at large will ever be indebted to him for his investigations of some of the most intricate parts of natural history. His experiments on digestion, on the fructification of marine plants and on corals, are all celebrated, although with respect to the latter he was mistaken in denying their animal nature; but his immortal work is his "*Mémoires pour servir à l'Histoire des Insectes*," in 6 volumes, quarto; and he has published a variety of detached pieces relating to the same subject.

The Italians possessed a similar genius to Reaumur in Vallisneri, whose experiments relating to generation, and his candour in giving up his first opinion on that subject, merit great commendation, as well as his investigations of intestinal animalcula. Vallisneri was professor of the practice of medicine at Padua, and died in 1730. His works, being only in Italian, are not so much read as they deserve to be.

The same country had the honour of producing another most excellent observer in Micheli of Florence, whose *Nova Genera Plantarum*, published in 1729, is a fundamental book in botany; it has the rare merit of being a work of original and accurate observation in the most difficult of all plants, grasses, mosses and fungi. If Dillenius and Linnæus had paid due regard to his observations, they would not have so totally misunderstood the fructification of mosses as to take the capsule for the anthera. The world may still hope for more information from this excellent man,

on the publication of his manuscripts, now in the hands of Mr. Targioni Tozzetti, the worthy possessor of all his remains.

This leads me to mention the *Historia Muscorum*, published by Dillenius in 1741, that matchless work which, for the accurate delineation and determination of species, has never been rivalled in any department of botany, much less in that which it illustrates. This author has made the intricate tribe of mosses and algæ comparatively easy; without such a writer they would all probably have continued the opprobrium of botany, as fungi and confervæ are still.

A work worthy to be compared with this of Dillenius, for the more than Herculean labour which was employed in its composition, is the *Hierobotanicon* of Olaus Celsus, professor of divinity at Upsal, and one of the first and warmest patrons of Linnæus. He travelled to the East on purpose to enquire into the plants of Scripture, the determination of which was his darling object for more than fifty years. His book was not esteemed as it deserved

till its author was no more. There having been but 200 copies printed, it is now very rare, and is one of those works which are oftener talked of than read.

I shall only at present mention the names of two more writers, who chiefly distinguished themselves in vegetable physiology, Du Hamel and Hales*. One of them was the ornament of France, and the other of our own country, about the period of which I have been speaking, and both have rendered great services to philosophical botany.

In the mean while Linnæus was daily advancing in science and reputation. His *Fauna Suecica* appeared in 1746, and his *Materia Medica* in 1749; the former is a model of descriptive zoology, as the latter of methodical arrangement and concise-

* Father Fontana informs us that the works of Dr. Hales have been translated into Italian at Naples, by a very accomplished lady, Signora Maria Angela Ardinghelli, who took the pains to examine all his calculations, corrected some errors in them, and has added notes of her own. There is a plant in Commerson's herbarium named *Ardinghelia*, probably from this lady.

ness. They were both afterwards very much improved and enlarged, but the *Materia Medica* was never republished by Linnæus; all the new editions of it are by Professor Schreber, and the alterations are his own.

In 1751 appeared the *Philosophia Botanica*, and two years afterwards the first edition of the *Species Plantarum*; two works which it were equally vain and superfluous to attempt to praise as they deserve. I shall only remark that the introduction of *trivial names*, which first took place in the *Species Plantarum*, was one of the most happy inventions of Linnæus, and I am persuaded it has contributed more than any thing else to make his works of general use. Even those botanists who from envy would never openly adopt them, have given the most convincing proofs of the importance of which they thought them, in labouring to deprive Linnæus of the honour of their invention; and I could mention instances of people, who have written against these trivial

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names,

names, being obliged to recur to them daily in speaking and writing of plants.

The fame of Linnæus was now so widely diffused that, as his excellent biographer Dr. Pulteney has observed, he began scarcely to feel the disadvantages of his northern situation. He had disciples in every part of the world who vied with each other in sending him all the objects of natural history they could procure, so that his cabinet and his garden were equally enriched. At the same time most of the learned societies in Europe were proud to enrol him among their members, and even kings contended for the possession of him. He was amply indemnified for declining the generous offers of the Spanish monarch, by the honours and advantages heaped upon him by his own sovereign. He received the rank of nobility, which in Sweden is neither a trifling nor a barren honour, and was made a knight of the Polar Star. This was the first instance of that order having been conferred upon literary merit; certainly it could never
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have been bestowed with greater propriety on any one than on Linnæus, who was himself that bright polar star to which the scientific world looked up for assistance and direction.

This then may be reckoned the most flourishing period of Natural History, when disputes about methods and systems being for the most part laid aside, every admirer of Nature's works was employed in practical observations and discoveries; while Linnæus, whom nothing escaped, and to whose decision all doubts and difficulties were referred, supervised and methodized the whole. His improvements had so much facilitated the study of botany, that it was no longer an abstruse science confined to the schools, but became an agreeable amusement to persons of leisure in all ranks and situations.

About this time some most superb works in natural history were given to the public, which, although not very systematic, were of use to the science; as Seba's *Thesaurus Rerum Naturalium*, the first volume of which

which appeared in 1734, and the second in 1735, the two following ones not having been published till many years after; Catesby's Natural History of Carolina, Florida, &c. of which the first volume was printed in 1731 and the second in 1743; Edwards's History of Birds, begun in 1743; and some others of less note. A work of a superior kind was published at Florence in 1742, entitled Gualtieri Index Testarum Conchyliorum, which is remarkable for the perfection of its specific differences of shells, in which the author seems closely to have imitated the style of the botanical works of his countryman Micheli. This is one of the most useful books of reference that we have in conchology, and in my opinion is far preferable to the work of d'Argenville printed the same year, although perhaps less complete than the new and enlarged edition of that book lately published.

In England horticulture seems now to have made great progress. Few have improved that art so much as the celebrated
Miller;

Miller; and it is hardly fair to reproach him with not having perfected it. Bartram was sent to America for the purpose of supplying our gardens with plants; and we are much indebted to him, as well as to Houftoun, who discovered many rare vegetables in South America and the West Indies, and whose remains, long neglected, are now rescued from oblivion.

In Holland botany was ably supported by the labours of the two professors Van Royen at Leyden, and the assiduous Burman professor at Amsterdam. The *Thesaurus Zeylanicus* and *Decades Plant. Africana-rum* of the latter are excellent books: some of the figures in this last which I find Linnaeus suspected to be erroneous, or even fictitious, have since been found faithful. Burman had also the honour of publishing a large volume of the figures of Plumier, from copies of the original drawings, which had long lain buried at Paris, as the greater part of that admirable author's works still do, eclipsed by more splendid productions.

In Germany Professor Ludwig of Leipsic
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was now in great reputation; and he has shewn himself an able physiologist and accurate observer. He professed to differ in many points from Linnæus, but opposed him with decency; and indeed it appears, as a noble author of our own country has lately remarked, that Ludwig, as well as Haller, were only "Linnæans in disguise;" they profited of the lights they had received from him to build systems to rival his own.

No where have the Linnæan improvements been more slowly received than in France, which is to be attributed not only to the jealousy of that nation for the fame of her immortal Tournefort, but also to her possessing some consummate botanists, of sufficient consequence to support for a time any system they should choose to espouse. Among these the family of the Jussieus claim the first place, and especially Bernard de Jussieu, a name never mentioned without respect. Even at Paris however Linnæus had early an illustrious protector in the Duke d'Ayen, now Marechal de Noailles, who corresponded with him long,
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procured him the notice and favour of the late king, and occasioned his majesty to send him a present of seeds from his own garden at Trianon. The work of Adanson has also done service to the Linnæan cause, although certainly that was what its author least intended; but this is one of those books every reader of which must dissent from the author's opinions. In the south of France Linnæus had more admirers. Professor Gouan of Montpellier has adopted his principles both in his ichthyological and botanical works; and the excellent Gerard in his *Flora Galloprovincialis*, although he has not followed the system of Linnæus, is every where closely attached to his principles, and has ever been an enthusiastic admirer of his merit. Nor must I forget Professor Sauvages of Montpellier, who generously presented Linnæus with his whole herbarium, rich in the plants of that delightful country; nor his friend Monsieur Le Monnier, one of the warmest admirers of the illustrious Swede. This gentleman was sent to the south of France

as a botanist in 1740, with some other philosophers who went there for astronomical purposes. Afterwards he became first physician to Louis XV. and now enjoys his "*otium cum dignitate*" in a delightful retirement near Versailles, where he pays particular attention to the cultivation of trees and shrubs, and possesses one of the richest herbariums in France.

At Berlin botany and Linnæus had long a noble support in Professor Gleditsch, who first principally distinguished himself by answering Siegesbeck's criticism of the Linnæan system; and his victory was decided indeed when Siegesbeck published his *Vaniloquentiæ Gleditschianæ Specimen*, in the first paragraph of which that writer gives him what may almost be called "the lie direct." But Gleditsch was better employed than in returning it. He applied himself to the investigation of the obscure physiology of Fungi and other orders of the Cryptogamia, and in 1753 published an able and elaborate work, entitled *Methodus Fungorum*. The Memoirs of the Ber-

lin Society abound with excellent treatises of this author relating to agriculture and rural œconomy. Nor did he neglect systematic botany. By no means a servile follower of Linnæus, he published in 1764 a system founded on the situation of the stamina, the principle of which is good, and must always be kept in view by all botanists; but the classes of Gleditsch being solely founded on this circumstance, are necessarily too few: his orders are borrowed from the classes of Linnæus.

Botanical works were daily multiplying in various parts of Europe. In 1745 appeared Leche's *Primitiæ Floræ Scanicæ*, and Seguiet's rich catalogue of the *Plantæ Veronenses*. It has been alleged by some fastidious people, that the present century, and especially the Linnæan age, has been overburthened with such kind of catalogues, which require no abilities in their composition, and answer no purpose when done. A French writer, whom I am tired of naming, has declared himself of this opinion; and his own practice has been so conformable

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able to it, that he has never favoured the world with an account of the plants of Senegal, a country which he went purposely to investigate. Happily all good botanists have not imitated him, or we should never have seen Scopoli's inestimable *Flora Carniolica*, the various Floras of Allioni, De Gorter, Gunner, Hudson, Gouan, Leers, Pollich, Weis and many others, which have been of great use to local, and indeed general botany; and even if every one of the valuable works just mentioned had been useless, who would not have thought them sufficiently atoned for by the *Flora Laponica* and *Flora Suecica* of Linnæus?

I am now led to consider the services rendered to natural history by the various disciples of this eminent man, and others, who have undertaken hazardous and laborious journeys, on purpose to examine the productions of countries hitherto not at all or but slightly investigated. And what praise does not the ardour of such active promoters of science deserve? As no one ever felt more of this ardour than Lin-

næus,

næus, when the humble attractions of an arctic flora incited him to undertake his painful Lapland tour; so I think none has been so successful as this great man in exciting the same spirit in others. Before I speak of his pupils, however, the order of time obliges me to mention Buxbaum and Gmelin. The former may be slightly passed over. He was sent by the Petersburg Academy to collect plants in the Levant. The fruits of his labours are published in five *Centuriæ*, with wretched plates and very indifferent descriptions. The same society were much more fortunate in their choice of Gmelin to undertake the examination of Siberia. That country had before been visited by Gerber and some other botanists, but their acquisitions were trifling compared with those of Gmelin, who spent ten years, viz. from 1733 to 43, in Siberia. His *Flora Sibirica*, now increased to four volumes quarto, with an immense number of figures, and excellent descriptions and synonyms, is one of the best works of the kind, and contains many

very rare plants. Philip Frederick, the brother of this author, has written *Otia Botanica* and some other things. Samuel Gottlieb Gmelin, son of the last mentioned, is celebrated for his history of the genus *Fucus*, printed at Petersburg in 1768.

The expedition of Ternstroem, one of the first of Linnæus's disciples whom the spirit of curiosity led to visit countries far remote from his own, was an unfortunate one. This young man undertook a voyage to China in 1745, but died at Poulicandor. We have no history of his voyage. His memory is honoured with a plant in the *Supplementum Plantarum* at the instigation of Mutis, for Linnæus himself had not an high opinion of his merit.

Kalm, who visited North America in 1747, was more fortunate. His travels are so well known, from the account of them translated into English, that I need say little about them. His botanical discoveries very materially enriched the *Species Plantarum* of his great master, and the Linnæan Herbarium abounds with specimens

mens brought home by him, distinguished by the letter K. His own collection of dried plants is said to be mouldering away in Sweden, in

“The lumber garret of his *wifer* heir.”

Hasselquist visited Egypt and the Holy Land in 1749. No one has shewn greater zeal or activity than this ingenious young man, whose premature death cannot be too much regretted. He was alike skilful in zoology and botany, as the account of his travels published by Linnæus, and since translated into English, sufficiently shews. In vain has an invidious author, who has himself long enjoyed an unsubstantial reputation, endeavoured to blast the memory of Hasselquist. His calumnies have been refuted by Dr. Sparrman, who has justly defended his countryman.

Osbeck, another traveller well known in England from the translation of his voyage, went to the East Indies in 1750, as chaplain to a Swedish ship. He spent some time in China, of the natural history

of which he has told us much, and has made known many new plants, among which is the *Osbeckia*.

Loeßing, a favourite disciple of Linnæus and an excellent botanist, undertook the examination of Spain in 1751, where he found many new and rare plants, and probably would have made many more discoveries, had his stay been longer in that rich, and hitherto almost unexplored country: but he left it for one still more interesting, South America, where he would, no doubt, have made a rich harvest, had his life and health been continued; but he was soon cut off, at the age of 27. His letters and botanical descriptions have been published by his illustrious master, who, in this instance, as well as on every other occasion, has given proofs of that sensibility which must ever make him as dear to humanity as to science.

I forbear to enlarge upon other expeditions of less note, as those of Montin and Solander to Lapland, Bergius and Falk to Gothland, &c. although each contributed
to

to the general stock of natural knowledge very much. It is to be regretted we have not had more information from Rolander, who visited Surinam and St. Eustatia in 1755. He sent home indeed several curious insects, mentioned in the *Systema Naturæ*; but I find, by a letter of Linnæus to Gerard, that he esteemed Rolander the first entomologist after Reaumur. A pupil of Linnæus, named Martin, visited Spitzbergen in 1758: he must not be confounded with Martens, who went to the same country in 1671, and whose rude figures are quoted by Linnæus. I must not omit Torren, who went twice to the East Indies, and described his whole voyage in letters to Linnæus, enriched with many observations relating to natural history, all which were published with Osbeck's voyage, and translated into English by Dr. Forster.

I am led to consider some of the most illustrious naturalists of the present age, whose works and whose discoveries have been long so generally known as almost to preclude the necessity of mentioning them,

were it not necessary to the uniformity of my plan. Of these Professor Jacquin claims the first place. He was first known by his *Historia Plantarum Americanarum*, published in 1763, in folio, with many figures, and which contains descriptions of a vast number of plants of South America, scarcely ever seen by any body else. This book has lately been republished, without any material addition, except that the plates are coloured; for its illustrious author has of late years applied himself to the improvement of botanical ichnography in the most eminent manner. Who has not seen and admired his *Hortus Vindobonensis* and *Flora Auftriaca*? And we have now no longer to regret the want of *differentia specifica* in the works of Jacquin; for, with a degree of candour which does him the highest honour, he has deigned to listen to the remonstrance of the younger Linnæus on this subject, and has given the essential characters of all the plants figured in his *Icones Plantarum rariorum*.

Another celebrated work is Brown's History

tory of Jamaica, published in 1756, and now very rare, as the copies remaining at the bookseller's, after the first sale of the book, were burnt. Its elegant plates were drawn by Ehret, the best botanical draughtsman of his time. The herbarium of Dr. Browne, who is still living in Ireland, was bought by Dr. Solander many years ago, and sent to Linnæus: the specimens are not splendid, but important for the determination of many obscure plants.

Two superb publications were set on foot by royal munificence in Denmark, Regenfus's History of shells, and the Flora Danica. The former has, I think, the superiority in point of execution over most works in natural history, except, perhaps, Baron Born's account of the shells in the Imperial Museum at Vienna. The Flora Danica, while under the direction of Oeder, was equally well executed; but Professor Muller, more of a zoologist than a botanist, continued it with less care and perfection. Its reputation will, I doubt not, soon be abundantly restored by the

abilities of Profeffor Vahl, to whose care it is now entrusted.

We must now look back a little to endeavour to do justice to some great names in zoology. The age of Linnæus has been no less brilliant in this branch of natural history than in botany: but before I enter upon the works of his immediate disciples or followers, I must speak of his adversary Klein, who objected to several of his alterations in zoology, with more reason on his side than any of the botanical opponents of Linnæus ever had; still his remarks have not been much attended to. He also, like all the other adversaries of our great teacher, laboured to find out contradictions in his works; as if the irregularities of Nature were to be laid to the charge of him, whose works and whose system are often obscure, merely from their consonancy with Nature. Klein deserves great praise for his multifarious works in zoology; he has left scarcely any part of the science untouched, and has treated it both systematically and physiologically.

I hasten

I hasten to a bright ornament of our own country, the ingenious, accurate and patient Ellis, whose discoveries relating to corallines form one of the most interesting events in the natural history of the present century, and whose name will ever be revered while scientific or personal merit are held in esteem. Nor is it possible for me, in paying this tribute to the memory of Mr. Ellis, to forget his friend and very counterpart Dr. Garden, to whom Linnæus was so much obliged in his last edition of the *Systema Naturæ* that I think no name occurs there more frequently. This gentleman, long resident in Carolina, is celebrated for his discovery of the Siren laceratina, that singular animal, for which Linnæus was obliged to form a new order in his system. Dr. Garden is now returned to this country. Long may it be before I am at liberty to pay that unreserved tribute to his merit which I have given to the departed Ellis*!

It

* That period is now arrived. A pulmonary consumption,

It is well known that Mr. Ellis was one of the first who clearly made out the animal nature of corallines, and his opinion on the subject is now universally adopted. In the beginning, however, he had an opponent in Dr. Bafter, a Dutch naturalist, who maintained a contrary opinion, and argued with great ingenuity for the vegetable nature of these bodies, asserting that the polypes were merely accidental inhabitants of them, and not a part of their substance. The same author has published several other works on different marine insects, worms and plants, under the title of *Opuscula Subseciva*, which are elaborate

sumption, under which Dr. Garden laboured when this discourse was first published, has since terminated his valuable life. Few characters could be more justly beloved in private, nor were sensibility and cheerfulness ever more happily combined. He was an American loyalist free from party bigotry. In scientific pursuits he sought only truth and nature for their own sakes, ever unassuming and unambitious, while his name gave authority throughout Europe wherever it appeared. The elegant and fragrant *Gardenia*, dedicated to him by his friend Ellis, is worthy to perpetuate his name.

and

and curious: they are the performances of a real observer.

This intricate part of natural history has been investigated by several other writers, as Bohadsch and Muller; but by none more ably than the celebrated Pallas, whose systematic work on Zoophyta is necessary to all who apply themselves to this study.

No branch of natural history, after botany, has for some years past had more attention paid to it than entomology. Nor is this to be wondered at. Botany necessarily leads to the study of insects; for it is impossible to investigate plants in their native situations, without having our attention perpetually awakened by the infinite variety of those active little beings, employed in a thousand different ways in supplying themselves with food and lodging, in repulsing the attacks of their enemies, or in exercising a more than Asiatic despotism over myriads below them. Thus many of the most systematic botanists of the present age, as Scopoli, Hudson, Allioni, have been led to the study of entomology,

Another

Another class of authors have undertaken to publish figures of insects, as Sultzer and Frisch, sometimes accompanied with their history at large, as in the excellent works of Roefel and Sepp. I doubt whether the coloured plates of the latter have ever been excelled in any department of natural history. A most elaborate work, consisting only of coloured plates of insects, was undertaken under the inspection of Linnæus, by Clerck, the author of which dying soon after it was published, had time to colour a very few copies only, and these are much valued by the curious. In my opinion this work is more remarkable for labour than skill, and is far excelled by that of our countryman Mr. Drury, which I hope I may, without being accused of partiality, rank among the very first of its kind. I need say nothing of Albin and Wilkes, whose plates were admired in their time, but are now eclipsed by many. The Entomologia of Schæffer, the celebrated naturalist of Ratisbon, so well known by his figures of Fungi, and other works, are very ably

ably and carefully executed. I have only two more entomological writers to mention at present, but those are very illustrious ones, Geoffroy and De Geer. The work of the former is an history, in French, of the insects found about Paris, with a few excellent plates, chiefly as examples of the different genera. This with the *Entomologia Carniolica* of Scopoli, and the works of Linnæus, are the classical books indispensably necessary to every systematic student of European insects. Those who wish to study their history and metamorphoses more fully, will find ample satisfaction in the inestimable work of De Geer, which is a counterpart of that of Reaumur, and equally extensive and accurate. Its author, a Swedish nobleman, deserves to be ranked among the most able promoters of the science which he cultivated.

I have before mentioned that the botanical system of Linnæus was not readily received in France. Still less regard was paid there to his zoological works; and this is principally to be attributed to the success of his great opponent the Count

de Buffon, whose splendid publications and captivating style of writing, so well calculated to dazzle the multitude and to charm the people among whom he lived, engrossed all the attention of his countrymen, and have been admired throughout Europe. Indeed, those who are least partial to this celebrated writer must allow that he has contributed much to encourage and promote the study of Nature, has made many valuable observations, and collected a variety of interesting facts. We must remember however that the facts of so theoretical a writer are always to be received with caution: not that I would suspect any philosopher of wilful misrepresentations, but a prudent theorist will scarcely trust his own eyes; and the world are pretty well agreed that the hypotheses of Buffon are, for the most part, the very essence of futility: though several have laughed at them, few have taken the pains to refute them*.

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* The capricious and precarious hypotheses, with which Buffon has deformed his very eloquent work
on

The French have long possessed a more systematic writer in Briffon, whose *Regne Animal*

on Natural History, have shocked all true naturalists and exact observers, who are used in the study of Nature to seek facts and reasons, not whimsies and chimeras. But this incorrigible inclination to wander in the regions of fancy, which seems to have been the reigning malady of Buffon, has never been better justified, or rather excused, than by Condorcet in his beautiful eulogium of this painter and colorist, rather than delineator, of Nature (Hist. de l'Acad. Royale des Sciences, année 1788, p. 56.). I shall here quote the words of that eminent philosopher and profound geometrician, who, by the sagacity and acuteness of his remarks, his wonderful art in combining the most remote analogies, his talent for making trifles interesting, the just and philosophical spirit which always accompanies his ideas, and for the grace and elegance with which he adorns every subject, will always be read with extreme pleasure by every person of taste.

“ M. de Buffon knew (says he) that Descartes had drawn the attention of mankind to philosophy only by the boldness of his systems; that he had rescued them from the yoke of authority and from their own indifference for truth, only by acquiring the command of their imagination and indulging their indolence; till freed at length from their chains, and excited by a thirst for knowledge, they had themselves become capable of choosing the true path. He had moreover
seen

Animal has great merit, and whose excellent and elaborate history of birds,
 none

seen in the history of the sciences, that the epocha of their considerable progress had almost always been that of celebrated systems, because, those systems exciting at the same time the activity of their adversaries and that of their defenders, every object comes to an accurate scrutiny, in which each party is so fastidious about the proofs of its opponents, that those proofs are multiplied on both sides as much as possible. Then every disputant resting upon all acknowledged facts, they are all submitted to a rigorous examination; till having exhausted all their arms, they are forced to look about for new facts, which may be used with more force and success.

“ Thus the most austere philosophy may pardon a naturalist for having given way to his imagination, provided that his errors have contributed to the progress of knowledge, though merely by occasioning a necessary opposition to them; and if the hypotheses of M. de Buffon upon the formation of the planets be contrary to the laws of that very system of the world of which he had been one of the first and most zealous defenders among the French, rigid truth, while it condemns those hypotheses, may still applaud the ingenuity with which their author has brought them forward. p. 62.—In his discourses upon animals, ideas which seem to come forth accidentally, mark the sensibility and loftiness of his soul, which however is always

none who pursue that part of zoology can be without.

England

ways visibly governed by a superior reason : we seem as it were conversing with a pure intelligence, endowed with so much human sensibility only as was necessary to make him intelligible and interesting to our weakness."

M. de Condorcet afterwards draws an ingenious comparison between those three great men, Aristotle, Pliny and Buffon ; and concludes with the following words : " Aristotle has often been misled by the vain metaphysics of words, the bane of Grecian philosophy, from which even the superiority of his mind could not entirely secure him. The credulity of Pliny has filled his work with fables, which render doubtful the facts which he records, even when they are not in themselves incredible. Nothing has been laid to the charge of M. de Buffon but his hypotheses : these are also a kind of fables ; but they are fables produced by an active imagination under the necessity of creating, and not by a passive one yielding to extraneous impressions. The genius of philosophy will ever be admired in Aristotle ; the arts and the ingenuity of the ancients will ever be studied in Pliny, and in him are to be found those touches which affect the mind with deep and solemn thoughts ; but M. de Buffon will always be read for amusement as well as instruction ; he will still be the means of exciting useful enthusiasm for natural knowledge, and mankind will be long in-

England too has produced a genius, at least equal to the latter, in Mr. Pennant, who has almost exhausted the three first

debted to him for those sweet sensations which a young mind experiences from the first contemplation of Nature, as well as for the consolations to be derived by a mind fatigued with the storms of life, in reposing itself upon the contemplation of the immensity of beings, peaceably submitting to eternal and necessary laws."

Another vigorous and characteristic passage of M. de Condorcet, upon this same subject, may be found in the very interesting Life of Voltaire which he has lately published, a work written with that philosophical liberty, of which there are scarcely any examples anterior to this epoch. "It is pretended (says he) that Voltaire was jealous, and it has been answered with this line of Tancred,

"De qui dans l'univers peut-il être jaloux ?"

Of whom in the world could he ever be jealous?"

But he was jealous, they say, of Buffon. How? The man whose mighty arm had shaken the ancient columns of Superstition's temple, and who aimed at transforming into men those vile herds who had so long groaned under the enchanter's rod? Could he be jealous of the brilliant and successful delineation of the manners of a few animals, or of the more or less ingenious combination of vain systems, belied by facts?" ——— FONTANA.

classes

classes of the zoology of Great Britain, and whose name and works are too celebrated to need my commendation here.

Before I return to Linnæus I must mention the illustrious Mr. Bonnet of Geneva, an enthusiastic admirer of the works of Nature, whose candour and ingenuity cannot but obtain our esteem, whether we adopt his theories or not. This author is so remarkably inattentive to nomenclature and systematic arrangement, that an acrimonious enemy of Linnæus has quoted him as assenting to his own illiberal sentiments of that great man; but I am sure nothing could be more unjust than to make Bonnet a partisan of such animosity. Happy are those true philosophers, who, by an attention to the works of the Creator, are led, like this amiable man, to make themselves better as well as wiser, and to diffuse not only knowledge but happiness on all around them!

Linnæus, whose powers were beginning to decline, published in 1771 the

Mantissa altera, which may be considered as his botanical testament. It is partly a collection of remarks and corrections made at different times, and contains, besides, descriptions of a number of new plants, of which the rich communications of Dr. Mutis, from the continent of South America, make a considerable part. This gentleman, and some other Spanish botanists his friends, have had the good fortune of investigating the countries of Mexico and New Granada, hitherto little known to botanists; and the fruits of their industry were all sent to Linnæus. Among them, the great variety of beautiful and very extraordinary new plants of the class Syngenesia are remarkable. The finest of all was honoured with the name of Mutisia, and published by the younger Linnæus in his *Supplementum Plantarum*, a work the foundation of which was laid by his illustrious father not long before his death. I forbear to enlarge upon this melancholy period of the history of our science, which deprived it of its brightest ornament.

ornament. The circumstances of the death of Linnæus, with the honours paid to his memory, are known to all; nor need I on the present occasion make any artificial display of his merits, or of the loss which science sustained by his death. I am convinced none of my hearers has any thing to learn on this subject, and I would rather prefer the more cheerful task of tracing the success of his labours, and the effect of the spirit he had raised, in the enterprises and discoveries of many eminent naturalists, several of them his immediate pupils, whose deserved fame reflected such distinguished honour on the last years of their great teacher.

Here however a new difficulty presents itself. In the former part of this discourse, having principally had occasion to speak of authors no longer living, and known to us chiefly by their works, I have, to the best of my judgment, given an impartial and unreserved account of their merits. Glaring defects have been generally pointed out, but I have more

frequently indulged in the more agreeable office of praising merit of all kinds wherever it occurred. In so doing I have not been actuated by a senseless veneration for former times, nor have I preposterously aimed by a vain and useless homage to

——“soothe the dull cold ear of death.”

To excite laudable emulation has been my only intention. But now that I find myself either treading (to use Dr. Johnson's words) on ashes not yet cold, or am to speak of naturalists with whom I am personally connected, and of others whose approbation and esteem I cannot but be anxious to obtain, even the just tribute of applause might appear like servile adulation. This consideration, added to my having already extended my discourse to an immoderate length, will I hope justify me in touching now but slightly on many great names and many arduous undertakings, especially as I could but repeat facts and circumstances familiar to all, and should run the risque of exhausting the patience

of

of my hearers without giving them any information. I am persuaded no one whom I have now the honour of addressing needs to be informed of the merits of a Thunberg, Sparrman, Pallas, Fabricius, Swartz, or Hedwig, of the vast physiological discoveries of a Camper or Hunter, much less of the liberality and extensive knowledge of a Banks, or the genius and worth of the ever to be lamented Solander. Who is not acquainted with every circumstance of that celebrated voyage round the world, which has enriched every branch of natural knowledge in so eminent a degree? Who has not observed with pleasure the laudable emulation of a neighbouring country in promoting similar undertakings, to which we are indebted for the botanical acquisitions of Commerfon, Sonnerat, Aublet and Dombey? When I consider all these, added to the discoveries of Pallas in Siberia, of Sparrmann, Masson and Thunberg at the Cape, and especially the acquisitions which the latter, undismayed by the most formida-

ble difficulties, made in Japan ; when I contemplate the distinguished abilities of many other living naturalists, the excellent publications of Schreber, Rottboll, Retzius, Allioni, Scopoli, Broussonet, L'Heritier, the philosophical Herman, and many others, not to mention some in our own country which may vie with any of these, I am induced to consider the present age as one of the most propitious to the study of Nature on the most solid and philosophical principles ; and when I look around me at home, and see how very much the love of botany in particular, and the cultivation of plants, is increasing among persons of rank and fortune, as well as the treasures which are daily enriching our gardens and cabinets, I cannot help indulging the most flattering hopes that my own country will soon in an eminent manner be distinguished above the rest of Europe in these useful and pleasing pursuits. But the degree of credit we have already acquired must not lull us into a torpid security. We must
keep

keep in mind that France, our rival in power, is also our rival in science; and even at Paris Linnæus has now his followers, who, despising all national prejudices, dare to admire truth and genius wherever they find them. Let this excite in us a laudable spirit of emulation; not the narrow jealousy which distinguishes those, who, conscious of their own weakness or undeserved reputation, dread every approach towards perfection in others. All who pursue the same studies should labour together for the common good: every degree of assistance, every deserved commendation which they give to each other, is the most probable means of advancing their own fame; while every atom of usurped honour, if it does not immediately cover its vain possessor with opprobrium, is almost certain to be deducted with interest from his character by a discerning and impartial posterity.

It now only remains for me to point out what I conceive to be the peculiar objects of our present institution. I need
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not enforce the propriety of each of us endeavouring to promote as much as possible the main ends of our undertaking, and to contribute all in our power to the general stock of knowledge. These are indispensable obligations upon all who associate themselves with any literary society. Those who do not comply with them incur disgrace instead of honour, for a title is but a reproach to those who do not deserve it; nor can they have a share in the reputation of a society, who never in any manner contributed to its advancement.

Besides an attention to natural history in general, a peculiar regard to the productions of our own country may be expected from us. We have yet much to learn concerning many plants, which authors copy from one another as the produce of Great Britain, but which few have seen; and our animal productions are still less understood. Whatever relates to the history of these, their œconomy in the general plan of Nature, or their use to man

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in particular, is a proper object for our enquiries. Of the productions of our own country we ought to make ourselves perfectly masters, as no natural object can any where be studied half so well as in its native soil. This however not being always practicable, botanic gardens and cabinets of natural history have been invented, in which the productions of the most distant climes are brought at once before us. No country that I know of can bear a comparison with England in this respect. The royal garden at Kew is undoubtedly the first in the world, and we have a number of others, both public and private, each of which may vie with the most celebrated gardens of other countries. Nor have we a less decided superiority in cabinets. That of the British Museum, which contains among other things the original herbariums of Sloane, Plukenet, Petiver, Kæmpfer, Boerhaave, of many of the disciples of Ray, and several others, besides innumerable treasures of zoology, claims the first place. That of
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the late Sir Ashton Lever stands I believe unrivalled in birds and quadrupeds; not to mention many others. But is it not a reproach to the naturalists of Great Britain that so many rarities should remain in their hands undescribed? that foreigners should eagerly catch at one or two plants obtained from our gardens, which we for years have been trampling under foot unnoticed? Yet how, till now, could such nondescripts have been made public? Large works in natural history are expensive, and of hazardous sale; few private people can undertake them; nor has there hitherto been any society to which detached descriptions could be communicated. It is altogether incompatible with the plan of the Royal Society, engaged as it is in all the branches of philosophy, to enter into the minutiae of natural history; such an institution therefore as ours is absolutely necessary, to prevent all the pains and expence of collectors, all the experience of cultivators, all the remarks of real observers, from being lost

to the world. The slightest piece of information which may tend to the advancement of the science we should thankfully receive. However trifling in itself, yet combined with other facts, it may become important. Whatever relates to the determination of species, even in the lowest and seemingly unimportant tribes of Nature's works, ought never to be neglected. Nor let the humble and patient student of this very difficult part of natural history be discouraged by the sneers of the supercilious coxcomb, or of the ignorant vulgar. He who determines with certainty a single species of the minutest moss or meanest insect, adds so far to the general stock of human knowledge, which is more than can be said of many a celebrated name: no one can tell of what importance that simple fact may be to future ages; and when we consider how many millions of our fellow creatures pass through life without furnishing a single atom to augment this stock, we shall learn

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to think with more respect of those who do.

But nothing will be with more reason expected from the members of this society than a strict attention to the laws and principles of Linnæus, so far as they have been found to be good. No where have his works been more studied and applied to practice than in this country, nor can any other be so competent to estimate his merits or correct his defects. I am persuaded nothing can be done more useful to the science of natural history than, working on the publications of this illustrious man as a foundation, to endeavour to give them that perfection of which they are capable, and to incorporate with them all new discoveries. We who have it in our power to give real information, should despise the silly vanity of making new systems or arrangements, merely for the sake of being talked of. An artificial method like that of Linnæus may be changed a thousand different ways, and
each

each seem best to its inventor. If any one, despairing of getting immortality by any other means, should please to name Cryptogamia the first class and Monandria the last, I should rank him but with Christopher Knaut, who made about as wise an attempt upon the method of Ray.

Whatever we may think of the system of Linnæus, there are certain great principles laid down by him, the excellence of which is now so well known, and so generally admitted, that none who pretends to the name of a naturalist can avoid conforming to them. The laws, for instance, according to which he constructed his *generic names* and *specific differences*, which we should do well to imitate, although less strictly, in the application of *trivial names*. I hope never to see any descriptions sent into the world by this society without specific differences: they are what distinguish a true scientific naturalist from an empiric, and nothing but incapacity in an author can make us pardon the want of them. Without a strict attention to this maxim,

maxim, the science will soon relapse into its original barbarism, nor can any thing but another Linnæus restore it. Let not the excellent work of my friend Mr. Latham be here cited against me; for that ingenious author is too judicious to have neglected this material point; he is possessed of the essential characters of all his birds, and means to publish them in a systematic form as a supplement to his great work. I wish I could make the same apology for some other eminent writers. But how would their works shrink if reduced to Linnæan conciseness and precision!

A kind of knowledge which naturalists have a right to expect from us in a superior degree, is the accurate determination of the species described by Linnæus, and indeed those of many other authors. Our access to the several original collections I have mentioned, to the immense herbarium of Sir Joseph Banks, which contains the entire collections of several celebrated botanists, but more especially to the very
herbarium

herbarium and museum of Linnæus himself, must give us means of knowledge not to be had elsewhere. This is a subject on which I speak with peculiar pleasure, as in this respect I may hope to be infinitely more useful to the present institution, than could have been expected from any abilities of my own. A train of events, which I cannot help calling most fortunate, having brought into my hands every thing which Linnæus possessed relating to natural history or medicine, his entire library, manuscripts, and the correspondence of his whole life, as well as all the acquisitions made by the younger Linnæus in his tour through Europe, after his father's decease, but which his own premature death prevented him from communicating to the world; all these will be a never-failing resource to us in every difficulty, as well as a fund of information not easily to be exhausted. For my own part I consider myself as a trustee of the public. I hold these treasures only for the purpose of making them

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useful to the world and natural history in general, and particularly to this society, of which I glory in having contributed to lay the foundation, and to the service of which I shall joyfully consecrate my labours, so long as it continues to answer the purposes for which it is designed.

III.

OBSERVATIONS

ON THE

IRRITABILITY OF VEGETABLES.

*From the PHILOSOPHICAL TRANSACTIONS
for 1788.*

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OBSERVATIONS *

ON THE

IRRITABILITY OF VEGETABLES.

*Read at the ROYAL SOCIETY,**Feb. 14, 1788.*

HAVING often heard that the stamina of the Barberry, *Berberis communis*, were endued with a considerable degree of irritability, I made the experiment in Chelsea Garden, May 25, 1786, on a bush then in full flower. It was about one o'clock P. M. the day bright and warm, with little wind.

The stamina of such of the flowers as were open were bent backwards to each petal, and sheltered themselves under their

* A French translation of this Paper by M. de la Metherie was printed in Rosier's Journal for July 1788, vol. 33.

concave tips. No shaking of the branch appeared to have any effect upon them. With a very small bit of stick I gently touched the inside of one of the filaments, which instantly sprung from the petal with considerable force, striking its anther against the stigma. I repeated the experiment a great number of times; in each flower touching one filament after another, till the tips of all six were brought together in the centre over the stigma.

I took home with me three branches laden with flowers, and placed them in a jar of water, and in the evening tried the experiment on some of these flowers, then standing in my room, with the same success.

In order to discover in what particular part of the filaments this irritability resided, I cut off one of the petals with a very fine pair of scissors, so carefully as not to touch the stamen which stood next it: then, with an extremely slender piece of quill I touched the outside of the filament which had been next the petal, stroking

stroking it from top to bottom; but it remained perfectly immoveable. With the same instrument I then touched the back of the anthera, then its top, its edges, and at last its inside; still without any effect. But the quill being carried from the anthera down the inside of the filament, it no sooner touched that part than the stamen sprung forwards with great vigour to the stigma. This was often repeated with a blunt needle, a fine bristle, a feather, and several other things, which could not possibly injure the structure of the part, and always with the same effect.

To some of the antheræ I applied a pair of scissars, so as to bend their respective filaments with sufficient force to make them touch the stigma; but this did not produce the proper contraction of the filament. The incurvation remained only so long as the instrument was applied; on its being removed, the stamen returned to the petal by its natural elasticity. But on the scissars being applied to the irritable part, the anthera immediately flew to

the stigma, and remained there. A very sudden and smart shock given to any part of a stamen would, however, sometimes have the same effect as touching the irritable part.

Hence it was evident, that the motion above described was owing to an high degree of irritability in the side of each filament, next the germen, by which, when touched, it contracts, that side becomes shorter than the other, and consequently the filament is bent towards the germen. I could not discover any thing particular in the structure of that or any other part of the filament.

This irritability is perceptible in stamina of all ages, and not merely in those which are just about discharging their pollen. In some flowers, which were only so far expanded that they would barely admit a bristle, and whose antheræ were not near bursting, the filaments appeared almost as irritable as in flowers fully opened; and in several old flowers, some of whose petals with the stamina adhering

to

to them were falling off, the remaining filaments, and even those which were already fallen to the ground, proved full as irritable as any I had examined.

From some flowers I carefully removed the germen, without touching the filaments, and then applied a bristle to one of them, which immediately contracted, and the stigma being out of its way, it was bent quite over to the opposite side of the flower.

Observing the stamina in some flowers which had been irritated returning to their original situations in the hollows of the petals, I found the same thing happened to all of them sooner or later. I then touched some filaments which had perfectly resumed their former stations, and found them contract with as much facility as before. This was repeated three or four times on the same filament. I attempted to stimulate, in the midst of their progress, some which were returning, but not always with success; a few
of

of them only were slightly affected by the touch.

The purpose which this curious contrivance of Nature answers in the private œconomy of the plant, seems not hard to be discovered. When the stamina stand in their original position, their antheræ are effectually sheltered from rain by the concavity of the petals. Thus probably they remain till some insect, coming to extract honey from the base of the flower, thrusts itself between their filaments, and almost unavoidably touches them in the most irritable part: thus the impregnation of the germen is performed; and as it is chiefly in fine sunny weather that insects are on the wing, the pollen is also in such weather most fit for the purpose of impregnation. It would be worth while to place a branch of the Barberry flower in such a situation, as that no insect, or other irritating cause, could have access to it; to watch whether in that case the antheræ would ever approach

proach the stigma, and whether the seeds would be prolific.

I have been the more particular in these observations upon the Barberry, because although several authors mention the irritability of its stamina, none, that I can find, have related in what part of the stamina this property resides, or the purpose it serves; at least they have not pursued their inquiries with any great degree of accuracy, but seem mostly to have copied one another. GMELIN, who has written a dissertation expressly on the irritability of vegetables, has scarcely any thing new on the subject; the chief part of his work is a catalogue of plants which he found *not* to be irritable.

The Barberry is not the only plant which exhibits this phænomenon. The stamina of *Cactus Tuna*, a kind of Indian Fig, are likewise very irritable. These stamina are long and slender, standing in great numbers round the inside of the flower. If a quill or feather be drawn through them, they begin in the space of

two

two or three seconds to lie down gently on one side, and in a short time they are all recumbent at the bottom of the flower. The motions in *Dionæa muscipula*, *Mimosa sensitiva* and *pudica*, are too well known to be mentioned here. A similar phænomenon has been observed, where indeed an obvious botanical analogy would lead one to expect it, in the *Drosera*. See Dr. WITHERING'S Botanical Arrangement of British Plants. All these movements are, I think, certainly to be attributed to irritability. We must be careful not to confound them with other movements, which, however wonderful at first sight, are to be explained merely on mechanical principles. The stamina of the *Parietaria*, for instance, are held in such a constrained curved position by the leaves of the calyx, that as soon as the latter become fully expanded, or are by any means removed, the stamina, being very elastic, fly up, and throw their pollen about with great force. I have lately observed a similar circumstance in the
flowers

flowers of *Medicago falcata*. In this plant the organs of generation are held in a straight position by the carina of the flower, notwithstanding the strong tendency of the infant germen to assume its proper falcated form. At length, when the germen becomes stronger, and the carina more open, it obtains its liberty by a sudden spring, in consequence of which the pollen is plentifully scattered about the stigma. The germen may at pleasure be set at liberty by nipping the flower so as gently to open the carina, and the same effect will be produced.

As the foregoing experiments shew vegetables to possess irritability in common with animals, so there are plants which seem to be endued with a kind of spontaneous motion. LINNÆUS having observed that the Rue moves one of its stamina every day to the pistillum, I examined the *Ruta chalepensis*, which differs very little from the common Rue, and found many of the stamina in the position which he describes, holding their antheræ

over

over

over the stigma ; while those which had not yet come to the stigma were lying back upon the petals, as well as those which, having already performed their office, had returned to their original situation. Trying with a quill to stimulate the stamina, I found them all quite devoid of irritability. They are stout, strong, conical bodies, and cannot, without breaking, be forced out of the position in which they happen to be. The same phænomenon has been observed in several other flowers ; but it is no where more striking or more easily examined than in the Rue.

I could wish to find an instance of this spontaneous motion combined with irritability in one and the same plant ; but, I confess, I do not know one. From analogy I should think it not impossible that the *Dionæa muscipula*, and perhaps the *Drosera*, may have the same motion in their stamina as the *Ruta*, *Parnassia*, and *Saxifraga*, while their leaves possess irritability. But if this be the case, the seats of these two properties, being so different

and

and remote from each other, should seem to have as little connexion as if in two different plants. There still remains then this difference between animals and vegetables, that although some of the latter possess irritability, and others spontaneous motion, even in a superior degree to many of the former, yet those properties have hitherto in animals only been found combined in one and the same part. Even *Sertulariæ* are not an exception to this observation. The greater part of their substance, indeed, resembles that of plants in being indefinitely extended, and in wanting irritability and spontaneous motion. But their animated flowers or polypes, in which the essence of their being resides, are endued with both these properties in an high degree.

I know it is the opinion of some philosophers, that a certain degree of irritability must pervade every part of vegetables, as the propulsion of their fluids cannot well be conceived to be accomplished by any other means. In a conversation on this subject

subject with the celebrated M. BONNET, of Geneva, he informed me that he is strongly of this opinion; and that he should not despair, by throwing acid or other stimulating injections into the vessels of some plants, of seeing with a microscope at once the propulsion of the sap, and the contractions by which it is performed. He urged me, with that amiable enthusiasm for which he is remarkable, to pursue the inquiry. Whether I do so or not, I think the idea too interesting to be kept to myself, and should be glad to see it realized by any one who has time and abilities for such investigations, who has accuracy and coolness in making his experiments, as well as fidelity and impartiality in recording them.

I cannot conclude this Paper without taking notice of another very curious property which vegetables seem to possess in common with animals, although certainly in a very inferior degree: I mean, that property, to use the words of Mr. HUNTER, who has studied this principle to a
vast

vast extent in the animal œconomy, by which their constitution is capable only of a certain degree of action consistently with health; when that degree is exceeded, disease or death is the consequence. It is only by the help of this principle that I can explain why many plants resist a great degree of cold for several winters before flowering; but after that critical event, they perish at the first approach of cold, and can by no art be preserved so as to survive the winter. But a more curious instance is that mentioned by LINNÆUS, without an explanation, in his Dissertation on the Sexes of Plants, of the long duration of the pistilla in the female hemp, while unexposed to the male pollen; whereas those to which the pollen had access immediately faded and withered away. In this case, I cannot help thinking, that in those pistilla on which the pollen had acted, and which consequently had performed the function for which they were designed, the vital principle was much sooner exhausted than

in those which had known no such stimulus. It is, perhaps, for the same reason that double flowers, in which, the organs of generation being obliterated, no impregnation can take place, last much longer in perfection than single ones of the same species, as is notoriously the case with Poppies, Anemonies, &c. In single Poppies the corolla falls off in a few hours; but in double ones it lasts several days: and this may possibly, combined with other observations, lead to a discovery of the real use of the corolla of plants, and the share it has in the impregnation, about which there has yet been no probable conjecture.

IV.

REVIEW

OF

MR. CURTIS'S BOTANICAL MAGAZINE,

OR

FLOWER-GARDEN DISPLAYED.

*From the ANALYTICAL REVIEW, Vol. 3,
for January 1789.*

REVIEW

MR. CURTIS'S BOTANICAL MAGAZINE

THE ingenious author of the Floras
 Londinensis, having by that work just-
 ceintly established his reputation among
 the most enlightened botanists of Europe
 condescends, in the present more humble
 publication, to instruct and entertain those
 who are not always able or willing to con-
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 of information, or, to use his own words,
 "ladies, gentlemen, and gardeners." The
 plan of the work will be best understood
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REVIEW

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"The present periodical publication owes its commencement to the repeated solicitations of several ladies and gentlemen,

N 3

subscribers

subscribers to the author's botanic garden, who were frequently lamenting the want of a work, which might enable them not only to acquire a systematic knowledge of the foreign plants growing in their gardens, but which might at the same time afford them the best information respecting their culture; in fact, a work, in which botany and gardening, (so far as relates to the culture of ornamental plants,) or the labours of Linnæus and Miller, might be happily combined.

“ In compliance with their wishes, he has endeavoured to present them with the united information of both authors, and to illustrate each by a set of new figures, drawn always from the living plant, and coloured as near to Nature as the imperfection of colouring will admit.

“ He does not mean, however, to confine himself solely to the plants contained in the highly esteemed works of those luminaries of botany and gardening, but shall occasionally introduce new ones, as they may flower in his own garden, or
those

those of the curious in any part of Great Britain.

“ At the commencement of this publication, he had no design of entering on the province of the florist, by giving figures of double or improved flowers, which sometimes owe their origin to culture, more frequently to the sportings of Nature; but the earnest entreaties of many of his subscribers have induced him so far to deviate from his original intention, as to promise them one at least of the flowers most esteemed by florists.

“ The encouragement given to this work, great beyond the author’s warmest expectations, demands his most grateful acknowledgments, and will excite him to persevere in his humble endeavours to render botany a lasting source of rational amusement and public utility.

“ Botanic Garden, Lambeth Marsh,
1787.”

As a specimen of the style of the work, we shall select the account given of the

black Hellebore, or Christmas rose, No. 3,
fig. 8.

“HELLEBORUS niger.

“Black Hellebore, or Christmas rose.

“*Class and Order.*

“POLYANDRIA POLYGYNIA.

“*Generic Character.*

“Calyx nullus. Petala 5, five plura.
Nectaria bilabiata, tubulata. Capsulæ
polyspermæ, erectiusculæ.

“*Specific Character and Synonyms.*

“HELLEBORUS niger, scapo sub-bi-
floro sub-nudo, foliis pedatis. *Linn. Syst.*
Vegetab. p. 431. Sp. Pl. p. 783.

“Helleborus niger, flore roseo. *Bauh.*
Pin. 186.

“The true black Hellebore, or Christmas
flower. *Parkinson's Parad. p. 344.*

“As our publication seems likely to
fall into the hands of such as are totally

unacquainted with botany or botanical writings, it must plead as an apology for our often explaining many circumstances relative to plants, which may be well known to adepts in the science.

“ This plant derives its first name from the black colour of its roots ; its second from its early flowering, and the colour of its petals, which, though generally milk-white on their first appearance, yet frequently have a tint of red in them, which increases with the age of the blossom, and finally changes to green ; in some species of hellebore, particularly the *viridis*, the flower is green from first to last.

“ Black hellebore grows wild on the Apennine and other mountains, preferring such as are rocky.

“ If the weather be unusually mild, it will flower in our gardens, in the open borders, as early as December and January ; it may indeed be considered as the herald of approaching spring.

“ Like most other Alpine plants, it loves
a pure

a pure air, a situation moderately moist, and a soil unmanured: as the beauty of its flowers is apt to be destroyed by severe frosts, it should be covered during the winter with a hand-glass; or if it be treated in the manner recommended for the round-leaved cyclamen, it may be had to flower in still greater perfection.

“It is propagated by parting its roots in autumn. Neither this species, nor the *hyemalis*, thrive very near London.”

Each Number, price One shilling, contains descriptions similar to the above, of three plants, accompanied by a separate coloured plate of each. As each description is on a separate leaf, they may be arranged according to any method or order the purchaser may choose. A Number is published every month, and Twelve Numbers make a Volume, with which alphabetical indexes, &c. are given.

With respect to the execution of the figures, we cannot too strongly express our approbation. Although afforded at so cheap

cheap a rate, they would do credit to the most splendid works; indeed, we know no coloured plates, not even those of Jacquin, that excel them in beauty or truth. They are as much superior in elegance to the tawdry ostentatious works of Trew, as they are to those of Miller or Catesby in accuracy. We are aware that many of the plants, particularly the Alpine ones, are much altered by culture; and that the representations of such, in a work of this kind, must be less natural than if done from wild specimens. But that could not be avoided; nor, perhaps, may it be amiss that we should be furnished with representations of plants *avowedly* in a cultivated state, that they may be compared with those copied from specimens undoubtedly wild. We are aware likewise that the want of botanical dissections of the flowers may be objected to in these figures. But those who should be inclined to make such an objection, ought to consider how very much such an addition would have added to the labour and time necessary to make

the designs; and, indeed, the excellent artist has, in most cases, disposed the flowers with so much judgment, and under such a variety of appearances, that a discerning eye can generally discover in them all that is necessary to be examined.

The figures which appear to us to have the greatest share of merit, are many of the Iris's (a genus of plants to which the author seems partial), *Helleborus niger*, *Cactus flagelliformis*, *Geranium Reichardi* and *peltatum* (the leaves of the latter excellent), *Viburnum Tinus*, *Trillium fessile*, the lovely *Camellia japonica*, *Gentiana acaulis*, and *Lathyrus odoratus*; but, above all, *Tropæolum majus*, and the new *Passiflora alata*. The representation of the Moss Rose, in the 23d Number, although evidently meant to attract the eyes of the multitude, we think less happy. The expanded flower is ill drawn, and too uniform in colour, and the stalk of much too high a pink hue. We regret likewise that metallic whites should ever be used, being so liable to turn black, as has already

ready-

ready happened in the figure of the Jasmine, in No. 11.

We cannot help thinking that a work which keeps so closely to the elegance of Nature as this does, and which, we are happy to learn, has so extensive a sale, is likely to be useful, independently of the knowledge it conveys, in improving the taste of the nation. The productions of Mr. Wedgwood have already done so in another line. And indeed we begin to see, even in boarding-school embroidery, Nature *meant* to be imitated, instead of those glaring nothings with which the misplaced industry of our aunts and grandmothers used to deform their furniture. It is not improbable that such improvements may lead to a similar good taste and simplicity in mental qualifications.

We must not take leave of this work without observing, that it displays the critical knowledge of the author, wherever that can be done with propriety; and therefore, besides the new plants which it contains, becomes valuable to professed botanists,

nists, by the observations relating to many known ones. The culture of every one is particularly mentioned, and some difficult species are well discriminated, as *Hemerocallis flava* and *fulva*. We cannot, however, agree with Mr. Curtis in thinking the *Erica herbacea* a variety of the *mediterranea*, nor are we quite convinced of his *Narcissus major* being a good species. We wish him also never to let his style "outstep the modesty" of that Nature which he otherwise so closely imitates. We perceive some slight symptoms of it in the observations on *Mignonette*; but should scarcely have thought so trifling a blemish worth pointing out, had his work been less perfect in other respects.

V.

REVIEW

OF

A Synopsis of the Natural History of Great Britain and Ireland, containing a Systematic Arrangement and Concise Description of all the Animals, Vegetables, and Fossils which have hitherto been discovered in these Kingdoms. By John Berkenhout, M. D. 2 vols. crown 8vo. 10s. 6d. boards, 1789.

*From the ANALYTICAL REVIEW, Vol. 3,
for March 1789.*

THIS work first appeared in three volumes smaller than the present, about twenty years ago, under the modest title of *Outlines of the Natural History of Great Britain and Ireland*. It is now in many parts considerably enlarged.

The

The first Volume contains the Animal and Fossil Kingdoms. In his arrangement of the Animals Dr. Berkenhout follows Linnæus; but in his descriptions he has very properly derived assistance from all quarters, but especially from Mr. Pennant, whose works our author has principally relied on in determining what animals are indigenous to this country. He even thinks the system of this author preferable to that of Linnæus, and his only excuses for not adopting it are indolence and "a predilection," which must here mean prejudice, for that of his old master. We are sorry he could find no better reasons, and suppose after such a declaration his authority will not be of much weight in favour of either.

What we find most to admire in this work are the style and language, in which we think the author has greater merit than is commonly attributed to him. His descriptions are very concise, consisting of rarely more than four or five lines; but they are equally clear, easy and satisfactory.

tory. His language is professedly English, but he has retained all the Latin technical terms with their proper terminations; and we cannot but think this method far better than searching for obsolete uncouth terms, and using them because they are, or rather *once were*, English, in preference to elegant words far better understood, only because the latter belong to the learned languages. Is not this widening the breach between the learned and unlearned, and rendering them still more unable to converse together? Whereas by gradually making the unlettered student adopt scientific terms, which by the by he may as easily learn at first as the others, he is led on perhaps insensibly towards a knowledge of the languages from whence they are derived; at least he acquires an idea of the different constructions and inflexions of words in different languages, which will open his mind to further improvement. Thus for instance, why should *chives* and *pointals* be preferred to *stamina* and *pistilla*, *rundle* to *umbel*, *empalement*

to *calyx*, *threads* to *filaments*, or *tips* to *antheræ*? There is still less reason why the vile word *anther* and *anthers*, which is no language at all, should be substituted for the elegant termination of *anthēra*, or *anthēræ*, for so it should be pronounced, and not *anthēræ*.—The Genus *Rosa* may serve as a specimen of the author's style.

“ROSA. Calyx urn-fashioned, fleshy, quinquefid; segments long, narrow. Petals five, inserted in the neck of the calyx. Stamina and pistilla very short. Seeds numerous, downy, adhering to the inside of the calyx.”

Then follow the descriptions of the species.

“1. *Rubiginosa*. *Sweet Briar* or *Eglantine*. Firm, erect, spinous. Leaves roundish, generally five together, rusty on the under-side and clammy at the ends. Flowers small, pale. The whole plant smells like apples. May, June.

* *Ger.* 1269. 1.

* *Gerarde's Herbal*.

“2. Vil-

“ 2. *Villofa. Apple Rose.* Spinous. Leaves downy on both sides, oval. Fruit spherical, large, spinous. Flowers deep red. June.

“ 3. *Spinofiffima. Burnet Rose.* Stem firm, but low, much branched and very prickly. Leaves pinnated. Footstalks spinous. Flowers white. Fruit round and smooth. June. On heaths, &c. *Ger.* 1270. 4.

“ 4. *Canina. Dog Rose or Common Briar.* Stem eight or ten feet high, with hooked spines. Leaves five or seven together, oval, smooth. Flowers pale red, odoriferous. Fruit large, smooth, oval, red. May, June. Hedges. *Curtis*, v. 34.

“ 5. *Alba. White Dog Rose.* Differs from the last in being a less shrub, with rounder fruit, and white flowers.”

With respect to the additions and improvements in this new edition, the author tells us nothing has been done to the entomological part; still, although it con-

tains not a quarter of the insects known to be found in Britain, and is the weakest part of the work, it is the most complete we yet have on the subject. In the vegetable kingdom the author justly acknowledges the assistance he has had from the works of Hudson, Lightfoot, Curtis and Withering, most of whose plants he has adopted rather too implicitly; for not one of their errors, even the most notorious, is corrected. We were also much disappointed at finding no notice taken of the publication of the accurate and faithful Dickson, which is a professed supplement to the Floras of Hudson and Lightfoot, and contains new plants of the class Cryptogamia omitted by those authors. Indeed Dr. Berkenhout has not given all the plants of this class which even they have described.

In the mineralogical part he has made good use of Cronsted, but, we think, scarcely enough of Kirwan.

We cannot but observe that the work abounds with typographical errors, and

that the words *Lithophyton* and *Zoophyton* are erroneously derived from φύσις nature, instead of φυτόν a plant.

On the whole we think this a valuable and useful work ; extremely well calculated for those who, with a turn for system and an habit of observation, but without the lesser qualification of classical learning, are desirous of getting acquainted with those works of Nature which, being constantly before us, we are but too apt to overlook and despise.

VI.

R E V I E W

OF

An Easy Introduction to Drawing Flowers according to Nature. By James Sowerby. *Small quarto, sewed. 2s. plain, 4s. coloured.*

*From the ANALYTICAL REVIEW, Vol. 3,
for March 1789.*

THIS little work consists of six plates, in which a very great variety of forms of the seven parts of fructification of plants are delineated from nature with great accuracy, and made as clear as possible to the student by full explanations. It would be superfluous to commend the execution of these figures, as we have so lately done justice to the abilities of Mr. Sowerby as a draughtsman, in speaking of Curtis's Botanical Magazine. In the publica-
tion

tion now before us he shews himself to be scientifically acquainted with the parts of plants, without which indeed no botanical draughtsman can attain any degree of perfection.

In his language, although he has adopted terms which we have reprobated in speaking of Dr. Berkenhout's work, we cannot blame him, as he has followed authority which ought not to have misled him.

VII.

REVIEW

OF

Thoughts on the different Kinds of Food given to young Silkworms, and the Possibility of their being brought to Perfection in the Climate of England; founded on Experiments made near the Metropolis. By S. Bertezen, 8vo. p. 47. pr. 1s. 1789.

From the ANALYTICAL REVIEW, Vol. 3,

for May 1789.

THE two principal objects of this pamphlet are, to discountenance the opinion that young silkworms may be nourished with dried mulberry leaves, and to prove that the leaf of the black mulberry is preferable to that of the white, for the food of these useful and delicate little animals.

In

In the first instance, the author differs in opinion from several projectors abroad, among whom is Dr. Bellardi of Turin, who in a dissertation laid before the Society of Agriculture of that place, May 16, 1787*, proposes a method of drying and powdering the leaves in such a manner, as that they may be kept through the winter in sufficient preservation to feed the early worms, which are frequently hatched before young leaves appear; and the nourishment of which is a principal *desideratum* with the keepers of silkworms†. Our author's reasons against this practice are altogether hypothetical, as well as Dr. Bellardi's for recommending it; we shall therefore only observe, that we think his third objection the most forcible, and indeed nearly decisive, viz. the danger that

* Mezzo facile ed economico per nodrire i Bachi da Seta in mancanza della foglia recente dei Mori, dal Dottore Ludovico Bellardi. Torino 1787. 8vo.

† We have found from experience that the young worm will eat lettuce leaves, and thrive very well, before it has tasted the mulberry leaf.

the powder in question should enter into a state of fermentation when moistened, as it must be, and placed in the heat necessary for silkworms, 70 degrees of Fahrenheit's thermometer.

With respect to the preference of the black mulberry, as he judges from experience, we think him worthy of attention, how much soever he may differ from the generally received opinion. That the leaves of the white are, as he admits, the more early of the two, is however strongly in their favour; nor is there any obstacle to this kind being cultivated in England, as it grows very well here, and even in Sweden. Our author seems partial to the black, because he has it ready to his hands. Whether he is likely to prevail with all the owners of these trees to let him strip them, we cannot tell.

VIII.

R E V I E W

OF

*A Dutch Edition of the Systema Naturæ of
Linnæus.*

Read before the LINNÆAN SOCIETY,

March 3, 1789.

OF all the various impositions upon the public in the book-making way, to which the prevailing taste for Natural History and the celebrity of Linnæus have given birth in the present age, one of the most impudent and ridiculous is a folio edition of the *Systema Naturæ*, in Dutch, French, and English, published at the Hague in 1765, by a bookseller named Staatman. I have often contemplated this production with equal wonder and contempt, and have amused myself in conjecturing how the ignorant compiler of it could fall into
such

such strange errors as he has done. Sometimes I think I have traced his steps through the miry labyrinth; and if this Society will pardon me for presenting them with such trash, I will lay before them some of the fruits of my enquiries, for want of better matter for their entertainment. If they learn nothing else, they will at least be prevented from ever buying the book; for, though not so serious a robbery of the public as if it consisted of twenty-five folio volumes, any money which it might cost would certainly be equally thrown away with that laid out in the purchase of some such splendid publications.

That my opinion is not singular, will appear from Haller's *Bibl. Bot.* vol. ii. page 552, where the book I have undertaken to illustrate is distinguished by the title of *Systematis Linnæi corruptor*, and the character given of it is, that "it is by
 " no means the work of Linnæus, but a
 " mere bookseller's imposition; the figures
 " being bad, and their names totally erro-
 " neous, accompanied with such ignorance
 " as

“ as in the present age one would hardly
 “ expect to meet with.”

The scheme of this curious work is no less than to illustrate all nature ; so that, in the extensiveness of its plan at least, it may vie with the greatest attempts of the human mind. It professes to treat of Animals, Vegetables, Minerals, and Waters, in the two first classes following Linnæus, and in the two last Wallerius : so far then the plan was good ; we have nothing to complain of but the bad execution of it.

With respect to the three languages of this learned book, of the Dutch I am no judge, but I hope it is the best of the three. The French is like Dutch French, and for the English I can find no epithet too bad. It might seem invidious however to criticise this department, as every nation ought to think itself honoured by any attempt of a foreigner to speak or write its language, and I believe all but my countrymen do think so. A few observations, however, will be necessary to prevent errors.

By

By the *Night Men*, which our author says have only the appearance of an human body, we are not to understand those valuable members of society so called, whose services are so well known in every great town, however applicable the description may be ; but it is the Ourang Outang which is meant: and if in this instance our author has been obscure, he is abundantly explicit in his descriptions of the Monkeys, where his language could not be mistaken even by any night-man whatever ; the style indeed being more suited to what may be imagined, than of their usual discourse, than to any I should think fit to use before this company.

With respect to the explanation of the vegetable part of the system, a young student might be much misled by this work, and an old one puzzled in no small degree. The editor having turned to a dictionary for every word, with that perseverance for which his countrymen deserve great praise, has not always taken the right sense ; for perseverance without judgment
may

may often go very far out of the way. Thus he translates *filamenta* strings, *stigmata* stamps; and he commits errors in the characters of the classes which I confess myself incapable of unravelling. In *Syngenesia* he says “the Males and Fructifiers are monstrous.” In *Gynandria*, “The Males and Females have the members monstrous.” In *Monœcia*, “the Males and Females live in the same place, but in different *pipes*.”

I now come to the most curious part of this Natural or rather *Unnatural* History, the figures of plants, of which there are 126, and of those more than half, viz. near 70, are erroneously named; not that one obscure or ill understood species is merely put for another, as may happen in the best works; but *genera* the best known, and most common, are represented by figures which have no resemblance to them, but which represent plants equally well known; infomuch that one would suppose the names had been applied by lottery, for it is absolutely impossible that any one in the
least

least acquainted with plants could make such stupid blunders. That I do not exaggerate, will appear from the following account. It must be observed, that the plan of the work is to give a figure of one species of every genus in the Linnæan System, at the time this book was published; and the first part, which is all I have seen, and, I should hope, all that ever did or will appear, contains a specimen of each genus, or at least intended to be so, from *Canna* as far as *Mitchella*. But what would be the sentiments of the poor disappointed student, who should hope for information from this wretched farrago, when for *Thalia* he should find a diminished figure of *Kæmpferia*, actually a copy of one which stands next it? for *Boerhaavia*, a common *Equisetum*? for *Hippuris*, which the author is pleased to write *Hispurus*, another *Equisetum*? for *Corispermum*, *Alfne media* or some such plant? and for *Callitriche*, here written *Calitische*, a vile figure of *Androsace maxima*? From equal ignorance, for *Nyctanthes* is put

Anagallis

Anagallis arvensis, with a flower by it which I cannot make out.

For *Chionanthus*, an *Olea*.

For *Cinna*, an *Amaranthus*.

For *Eranthemum*, a thing like an *Adonis*.

For *Justicia*, *Capraria biflora*.

For *Pinguicula*, *Gentiana cruciata*.

For *Utricularia*, an apparent *Verbena*.

For *Monarda*, *Thymus Mastichina*.

For *Morina*, *Salvia glutinosa*, with a separate flower of the true *Morina*.

For *Buffonia*, a figure totally unlike that and every thing else.

For *Hirtella*, *Valeriana rubra*, and the author has the confidence to tell us that *Hirtella* is sometimes called Red Valerian.

For *Olax* is put *Polemonium cæruleum*.

For *Cneorum*, *Daphne Mezereum*.

For *Loeflingia*, *Statice Limonium*.

For *Polycnenum*, *Daphne Mezereum* again, if I am not mistaken.

For *Commelina*, a *Crocus*.

For *Bobartia* is given a figure so execrably bad one can hardly guess at its genus,

but I verily believe it is *Cytisus Laburnum*.

For *Cornucopia* is a figure still less intelligible.

For *Uniola*, a common *Poa*.

For *Festuca*, *Ægilops ovata*.

For *Aristida*, *Typha*.

For *Apluda*, *Juncus effusus*.

For *Eriocaulon*, *Herniaria*.

For *Montia*, I know not what.

For *Proserpinaca*, another kind of *Equisetum*, a genus of which the author has made good use.

For *Queria*, *Asperula adorata*.

For *Lechea*, *Asperula arvensis*.

For *Cephalanthus*, *Carlina*.

For *Globularia*, *Bellis perennis*.

For *Hedyotis*, a *Mentha*.

For *Knoxia*, *Lychnis dioica* with a double flower.

For *Siphonanthus*, *Imperatoria* I believe.

For *Catesbæa*, *Ægopodium podagraria*.

And for *Ixora*, *Mirabilis*.

Under the name of *Scurrula*, by which I do not know what is meant unless it be

be *Loranthus*, is put *Hedysarum coronarium*; and, to crown all at the last, for *Mitchella* is put *Nyctanthes Sambac*.

So large a list of blunders, in so small a compass, I believe scarcely any book in any science can afford. It is quite a phænomenon in literature.

These errors which I have enumerated seem totally unaccountable; they are like the ravings of a Maniac, whose origin or connection cannot be traced. But I shall now mention some others in which our author seems to have blundered with some ingenuity, or, as Polonius says of Hamlet, “to have method in his madness.”

In the first page is a figure named *Alpinia*, but which is nothing else than *Eryngium alpinum*; the trivial name of which it should appear made the ignorant compiler mistake it for *Alpinia*. A similar error made him exhibit *Amaranthus Blitum* for the genus *Blitum*. For *Lycopus*, he some how or other stumbled upon *Lycophis arvensis*. For *Amethystea* he has pre-

sented us with a fine double *Aquilegia*, because (I suppose) of its purple flower. And for *Anthoxanthum* he has given an *Hypericum*; very learnedly discovering that the word *Anthoxanthum* meant a yellow flower, he thought any plant of that colour would do. I must acknowledge he has not displayed his learning with equal success in giving *Valeriana hortensis* of the old authors (or *V. Phu* of Linnæus) for the genus *Ortegia*; though he has spelt *Ortegia* with an *H*, in order to make it more like *hortensis*. With respect to *Cassythia* he seems to have taken great pains, but with little success. He gives for it a figure of *Cuscuta*, and a flower of *Cassida*, or *Scutellaria*; so that in this case it was certainly pure ignorance that misled him, and not want of study.

After the mistakes already noticed, it will not seem wonderful that he gives *Carex pseudo-cyperus* for *Scirpus*, *Valeriana celtica* for *Nardus*, *Galium Mollugo* for *Mollugo*, or *Valantia Cruciata* for *Crucianella maritima*. In these cases he may

claim

claim our pity at least for having in some degree tried to be in the right; though that unhappy fatality which seems to have doomed him to be always in the wrong, made all his endeavours ineffectual. Certainly nothing but the most perverse destiny in the world could have made him publish *Lychnis dioica* for the *Diodia*: it is scarcely credible that so obscure a resemblance between the trivial name of that, and the generic name of the plant he meant to represent, could make him take one for the other; but I presume my hearers are by this time so well acquainted with this ingenious author as not to wonder at any thing he does, and most probably are heartily tired of him. I shall therefore, before I take leave of him, only mention one instance more, in which all evil stars seem to have combined to lead him into one of the most complicated blunders that even himself has ever committed; in making him give a figure of *Ferraria Pavana* for *Eriophorum*. Being at a loss for a representation of the latter, it appears

that he turned to some index or other for a word something like it, and by mischance met with *Bulbus Eriophorus* in *Dodonæus*: in the same chapter with which, by no less mischance, he found, along with a figure of the *Bulbus Eriophorus*, one of *Ferraria Pavonia* (the *flos Tigridis* of the old authors), and unluckily copied the one for the other.

... REVIEW OF A DUTCH EDITION, &c.
... be turned to some index or other for
... something like it, and by interchange
... with Bulow's Edition, in Deconan's
... the same chapter with which, by an
... interchange, he found, along with a
... of the Dutch, ... one of the
... of the old
... and which A
... copied the
... the other

IX.

BOTANICAL ESSAY
ON
THE GENERA OF
DORSIFEROUS FERNS.

TRANSLATED FROM THE LATIN.

*Published in the Fifth Volume of the Memoirs of the Royal
Academy of Sciences at Turin, in 1793.*

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2. BOTANICAL ESSAY

IX.

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BOTANICAL ESSAY

DORSIFEROUS FERNS

THE GENERA OF

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BOTANICAL ESSAY
ON
THE GENERA
OF
DORSIFEROUS FERNS.

THE Genera of Ferns, entirely neglected by the older botanists, and but slightly or superficially touched upon by systematic writers of the last century, were first attempted to be reduced to fixed principles by Linnæus. As no one mind can attend alike to every subject, Ray seems thoughtlessly to have retained the names, for I cannot call them opinions, of preceding botanists. Tournefort, somewhat more attentive to this part of botany, in order
to

to perfect his own great undertaking, aimed at referring ferns, as well as all other known vegetables, to their proper genera : but he unfortunately deduced his marks of diferimination from the figure of the frond, which is for the most part of no importance. His steps were implicitly followed by Plumier, who made known to the botanists of Europe a vast collection of American ferns, which he accommodated to the nomenclature of Tournefort. It is needless to mention any other writers of that period.

Linnæus, ever anxious to obtain generic characters of plants from their fructification alone, pursued this idea, truly worthy of so able a man, in the first edition of his *Genera Plantarum*, printed in 1737, in which he has arranged, according to this principle, many vegetable tribes, which no botanist had before supposed to be endowed with any such parts ; among others, the *dorsiferous ferns* are here for the first time presented to us in a well digested systematic form.

But

But indeed as in these plants the structure of the parts of fructification is less clear than in many others, those essential organs of their flowers, the *stamina* and *pistilla*, being altogether, as they still are, unknown, the great author of the Sexual System could by no means form his characters from thence. It was so far however sufficient for his purpose, that he could absolutely tell where those parts, if they did exist (and that they did he presumed from the most promising analogy), resided; and with respect to the fruit, the formation of which is the only end of the other parts of fructification, its structure was already clearly ascertained. But even this was useless for the purpose of which I am speaking, the fruit of almost all the dorsiferous ferns being nearly the same, so that the most intelligent observer could not from thence derive any generic distinctions. Linnæus was therefore in a manner obliged to have recourse to principles which in the arrangement of other classes of plants he had rejected as unphilosophical,

cal, the situation of the fructifications, and their aggregate figure. On these are founded the six genera of dorsiferous ferns which he has given in the first edition of his *Genera Plantarum*, as follows:

Pteris. Fructifications disposed in a line running along the margin of the leaf on its under side.

Lonchitis. Fructif. arranged in little crescent-shaped lines, under the sinuses of the leaf.

Adiantum. Fructif. in oval spots, collected together under the reflexed summits of the leaves.

Asplenium. Fructif. in straight lines, arranged on the under side of the leaf.

Polypodium. Fructif. in roundish spots, dispersed over the back of the leaf.

Acrosticum. Fructif. accumulated into one mass, entirely covering the back of the leaf.

In the second edition of the same work (Leyden 1742) two other genera are added to the above, namely,

Hemi-

Hemionitis. Fructifications in lines running into or intersecting each other, or branched.

Trichomanes. Calyx turbinated, solitary, erect, from the margin of the leaf itself. Style bristle-shaped, terminating the capsule.

In the latter description the illustrious writer varies his phraseology a little; and yet, if I may say so, not for the better, he having no sufficient authority in this case for using the words style and capsule.

The fifth edition of the same publication (Stockholm 1754) contains one more genus of ferns.

Blechnum. Fructifications disposed in lines, parallel with and near to the rib of the leaf.

The arrangement of the other genera is also a little altered.

In the sixth edition, the last to which Linnæus himself lent any assistance, nothing new occurs relative to the subject
before

before us, nor have I yet discovered any thing illustrative of it among his manuscripts.

All the editors and imitators of this great man's works, not knowing how to improve the genera of ferns, have left them as they were. The celebrated Schreber alone, in his new edition of the *Genera Plantarum* (Frankfort 1791, in two volumes), has given two new genera taken from other authors, *Marattia* and *Cænopteris*; adding moreover one of his own, which appeared to him to be new, named *Meniscium*. All these genera we shall presently notice.

It is proper, however, that we should here take notice of what has been done by some of the contemporaries of Linnæus, towards obtaining generic characters of ferns.

In the first place, Adanson, in his work entitled *Familles des Plantes* (Paris 1763), vol. 2. p. 20, has noticed the involucre of ferns, as has Gleditsch in his *Systema Plantarum* (Berlin 1764); but they have
detected

detected this part in very few genera, and have erred in several of their remarks upon it; for instance, in the *Pteris* of Linnæus (*Thelypteris* of Adanson, *Circinalis* of Gleditsch), the former well describes the involucre as of one valve, and in the form of a penthouse; while the latter denies its existence altogether. They both justly observe that in *Asplenium Scolopendrium* the involucre consists of two valves, but do not say a word of the form of this membrane in *Blechnum*, *Hemionitis*, or *Lonchitis*. They have totally deranged the Linnæan genera, but being ignorant of any true principles, have made every thing worse than they found it; and as to nomenclature, they have gone counter to every maxim and all sorts of authority. Both these writers have observed the elastic ring which binds together the capsular valves of ferns, but they have alike both equally erred in denying the existence of any such part in *Polypodium vulgare*. They have fallen into this mistake in blindly following Tournefort, for it might easily

have been avoided if they had but looked at the capsule themselves. Scopoli, in his *Flora Carniolica*, has made use of these authors remarks. The illustrious Haller, and most other writers, have adopted the Linnæan characters, with some occasional variations of no great moment, either with respect to the arrangement of species or nomenclature.

Nor indeed were any of the last-mentioned botanists under the necessity of going farther than Linnæus had done. Those however, who have had an opportunity of seeing many new exotic ferns, have long ago perceived the difficulty of referring them all to the Linnæan genera, and at the same time have found it equally difficult to fabricate new ones upon certain principles. In the year 1786, Sir Joseph Banks, at my persuasion, sent many specimens of rare and curious ferns, in full fructification, to the celebrated Dr. Hedwig at Leipzig, in hope that this ingenious man, who has thrown so much light upon other obscure parts of the class *Cryptogamia*, might also
illustrate

illustrate this order. I have not heard that he has undertaken their examination.

Having become possessed of a vast collection of ferns in the ample herbarium of the younger Linnæus, as well as by the favour of Sir Joseph Banks and some other friends, I have found it absolutely necessary to study the subject, in order to find out some method by which I might reduce my acquisitions into order. That I might proceed on as sure grounds as possible, I have made it a rule to examine every species that came in my way, before I would venture to lay down any fundamental principles. I have also consulted with some friends who had likewise paid attention to the subject, chiefly Mr. Dryander, and Mr. T. F. Forster jun.

It appears to me, that the involucre covering of the fructification is of the utmost importance in determining the genera of these plants, and it is especially to be noted on what side and in what manner this covering bursts.

Q

The

The involucre is of a membranous nature, and is found in almost every fern, covering the fructification before it arrives at maturity. It originates sometimes from the margin of the leaf, but more commonly from some nerve or vein. Nor must we neglect to observe, in order to come at the knowledge of natural genera, whether the membrane, and the fructification which it covers, be, with respect to the nerve or vein, *terminal* or *lateral*. The involucre adheres firmly to the frond on one side, and on the other is more or less closely pressed to it; not but that even on this side also the air is altogether excluded, so that in whatever mode the impregnation of the flowers is accomplished, the operation goes on in secret under this covering, independent of all external communication. For the membrane closely conceals and embraces every part, till the feed-vessels, being arrived at maturity, are ready to discharge their feeds; and that they are really feeds which these parts produce, has
been

been proved by the experiments of many naturalists *.

The principal thing to be noted for our purpose, respecting this membranaceous involucre, is the direction or mode in which it separates; that is, whether outwards (towards the margin of the frond), or inwards (on the side which looks towards the rib or nerve of the frond or of its segment). This circumstance no one has yet considered; yet it is undoubtedly of the greatest use in determining natural genera, being not only constant in every species, but in ferns whose habit and other particulars agree, it is always found to be similar. And so far is this principle from superseding or overturning the genera of Linnæus, that it rather strengthens them and confirms their characters; nor shall we often find it necessary to change the distribution of any of the Linnæan species. Neither do I make these remarks to prove the cha-

* See Mr. Lindfay's paper in the 2d vol. of the Transf. of the Linn. Soc. p. 93.

acters given by this great author now unnecessary; on the contrary, I retain them all, only begging leave to add to them my characters taken from the involucre, in order that his genera may be established on the more firm foundation, and that we may have certain principles on which to found new ones.

I mean at present to treat of such ferns only as are called *dorsiferous*, that is, which bear their fructification on the back of their frond. I therefore designedly pass over, not only those cryptogamous plants which professor Schreber in his new edition of the *Genera Plantarum* has denominated *Miscellaneæ*, but I likewise omit *Ophioglossum*, *Osmunda*, and *Onoclea*. This last is by the learned professor just mentioned erroneously referred to those ferns whose capsules are furnished with a ring. To his observations upon *Ophioglossum* and *Osmunda* every body must assent.

We now then proceed to the methodical distribution of the genera of dorsiferous ferns upon the maxims just proposed.

I may

I may at some future period illustrate them more minutely, and have now to beg that what is here offered may be considered as a mere essay, entirely submitted to the alterations and corrections of more able hands.

FILICES DORSIFERÆ.

Dorsiferous Ferns.

Essential Character. Fructificationes frondosæ in paginâ inferiore, aliquando marginales.

Fructifications on the back of the leaf, sometimes at the margin.

SECTION I.

ANNULATÆ, with *Annulated Capsules.*

Essent. Char. Capsulæ pedicellatæ, bivalves, uniloculares, annulo articulo elastico cinctæ. Fructificationes involucro membranaceo plerumque tectæ.

Capfules on footstalks, with two valves and one cell, bound with a jointed elastic ring. Fructifications generally covered with a membranous involucre.

I. ACROSTICHUM. Linn. *Fructificationes* maculam amorpham, continuam, difcum fere totum occupantem, formantes.

Involucreum nullum, nifi squamulæ vel pili capfulis interftincti.

Fructifications forming one continued fpot, of no determined figure, occupying almoft all the difc of the leaf.

Involucreum none, except little fcales or hairs interfperfed among the capfuls.

OBS. In this genus the capfuls, while young and tender, lie for the moft part hid in a fine down; fometimes they are intermixed with minute membranous fcales, and perhaps

perhaps both may serve the purposes of an involucre.

Examples of the Genus.

Acrostichum aureum of Linnæus.
 - - - - latifolium }
 - - - - villosum } of Swartz's
 and Osmunda peltata } *Prodromus.*

2. POLYPODIUM. Linn. *Fructif.* in punctis subrotundis, sparsis, non marginalibus.

Involucrum umbilicatum, undique fere dehiscens.

Fructif. in roundish, scattered, not marginal spots.

Involucrum umbilicated, separating on almost every side.

Obs. Polypodium vulgare, which is the original species of this genus, has no perceptible involucre. The groups of young capsules come forth naked from the substance of the frond. As however this circumstance seems peculiar to the

Q 4 species

species in question *, we should scarcely be justified in separating all the other reputed Polypodiums from it on that account. There might be more reason perhaps, considering the immensity of this genus as it at present stands, for distinguishing from those species which have a perfectly umbilicated and circular involucre, separating equally on every side, those whose involucre is a part of a circle, or reniform. But the limits between the two are so difficult to define, and to describe, that it seems much safest, till we get more information, to preserve the genus as it is generally understood.

Examples. (Involucre obsolete)

Polypodium vulgare *Linn.*

(Invol. umbilicated)

- - - trifoliatum.

* Polypodium phymatodes seems to produce its fructification in the same manner, but I am not certain that any more species do so.

(Invol.

(Invol. nearly reniform)

- - Filix mas.

- - marginale.

(Invol. crescent-shaped)

- - Filix foemina.

Perhaps this last rather belongs to
Darea, see below.

3. ASPLENIUM. Linn. *Fructif.* in lineolis
sparsis.

Involucrum e venâ lateraliter ortum
ducens, interius (i. e. costam versus)
dehiscens.

Fructif. in scattered lines.

Involucrum originating laterally
from a vein, and separating inwards,
(that is, towards the nerve.)

Examples. Asplenium Hemionitis Linn.

- - - monanthemum*.

4. DAREA†. Juss. Gen. 15. *Fructif.* in
lineolis sparsis.

Invo-

* *Plant. Ic. ex Herb. Linn. tab. 73.*

† In *Plant. Ic. tab. 50*, I retained the denomination
first given by Bergius to this genus in his confused dif-
fertation,

Involucrum e vena lateraliter ortum ducens, exterius (i. e. marginem versus) dehiscens.

Fructif. in scattered lines.

Involucrum originating laterally from a vein, and separating outwards (that is, towards the margin).

Examples. *Cænopteris furcata*. *Bergius* in the *Transactions of the Petersburg Acad.* for 1782.

fertation, being unwilling to change a printed name, however unmeaning. Indeed my mind was so occupied by the absurdity of that name, *Cænopteris*, (a new fern,) that I did not then observe its being repugnant to the Linnæan laws as well as to good sense, having been formed out of another existing generic name (*Pteris*), infomuch that I was very near giving the genus in question an appellation in this respect equally faulty, *Clethripteris*. As it is however on all accounts necessary that *Cænopteris* should be changed, I gladly adopt the name given to this genus in the classical work of Mr. de Jussieu, in honour of Mr. Dare, an English botanist of the time of Ray, who first discovered the *Trichomanes tunbridgense*.

Mr. de Jussieu indeed refers *Cænopteris* to his *Myriotheca* (*Marattia*); but that is an accidental mistake, as their characters have no affinity.

- Cænopteris rutæfolia* *ejusd.*
 - - - *vivipara* *ejusd.*
 - - - *rhizophylla* *Plant. Ic. tab. 50.*
 (a native of Hispaniola).

- Asplenium cicutarium* *Swartz Prod. 130.*
 - - - *flaccidum* *Forster Prod. 80.*

5. *Hemionitis*. *Linn. Fructif.* in lineolis
 sparsis, decussantibus, geminis, venæ
 approximatis.

Involucra e venâ ortum ducentia,
 utrinque exterius dehiscentia.

Fructif. in scattered branching lines,
 each of them double, with a vein
 running between.

Involucra originating from the vein,
 and each separating outwards.

See tab. 1. fig. 1.

Examples.

Hemionitis lanceolata. *Linn.*

- - - *palmata*.

Asplenium plantagineum.

- - - *grandifolium* *Swartz*
Prod. 130.

Meniscium *Schreb. Gen. Pl. 757?*

6. SCOLOPENDRIUM. *Fruētif.* in lineolis
sparsis, geminis, interveniis.

Involucra superficialia, sibi invicem
longitudinaliter incumbentia, futurâ
longitudinali dehiscentia.

Fruētif. in scattered double lines,
placed between two veins.

Involucra originating from the sur-
face*, lying over one another longi-
tudinally, and separating by a lon-
gitudinal future.

See tab, 1. fig. 2.

Obs. The character of this ge-
nus is directly the reverse of that of
Hemionitis. Both are sufficiently
distinct from Asplenium, nor ought
they by any means to be confound-
ed with it.

By the latin term *involucrum su-
perficarium* I wish to express an
involucrum which arises from the
surface or disc of the frond, not

* Or rather from the veins.

from

from the margin, nor from a nerve, but it is generally attached to a small vein.

Examples.

Asplenium Scolopendrium Linn.

- - - - Ceterach?

I have scarcely discovered any more species.

7. BLECHNUM. Linn. *Fruētif.* in lineis longitudinalibus, continuis, costæ adjacentibus.

Involucrum superficialium, continuum, costam versus dehiscens.

Fruētif. in longitudinal uninterupted lines, close to the nerve.

Involucrum originating from the surface, continued, separating towards the nerve.

Examples.

Blechnum occidentale Linn.

- - - australe.

Osmunda Spicant.

8. WOOD-

8. WOODWARDIA. *Fructif.* in punctis oblongis, distinctis, serialibus, costæ adjacentibus.

Involucra superficialia, fornicata, costam versus dehiscentia.

Fructif. in oblong separate spots, arranged in a regular series along the nerve.

Involucra originating from the surface, vaulted, separating towards the nerve.

See tab. 1. fig. 3.

Obs. My worthy friend Thomas Jenkinson Woodward Esq. L. L. B. F. L. S. well known by his various observations and dissertations relative to English plants, and no less eminent for candour than for science, has richly deserved this genus.

Examples. The following species are all that have come to my knowledge :

1. Wood-

1. *Woodwardia angustifolia*, fronde pinnatâ : pinnis linearibus acutis integerrimis ; (*sterilibus ferrulatis.*)*

Fronde pinnated ; pinnæ linear, acute and entire ; the barren ones minutely ferrated.* *

A native of Pennsylvania. I received a specimen by favour of Sir George Staunton, Bart.

2. *W. japonica*, fronde pinnatâ : pinnis pinnatifidis nervo nudo : lobis obtusis ferratis, stipite squamoso.

Fronde pinnated ; pinnæ pinnatifid, their main nerve destitute of fructification ; their lobes obtuse and ferrated. Stalk scaly.

* From Morison's figure.

* * *Acrostichum areolatum*. *Linn. Sp. Pl.* 1526.

Osmunda frondibus pinnatis, foliolis omnibus basi connatis lanceolatis, margine leviter ferratis.
Gronov. Fl. Virgin. 4to, p. 164.

Lonchitis major Virginiana, folio vario, alis Polypodii in modum conjunctis. *Morif. Hist.* vol. 3. sect. 14. p. 569. tab. 2. f. 24.

Filix Floridana, &c. *Pluk. Phyt.* t. 399, f. 1.

Blechnum

Blechnum japonicum. *Thunb. Flo. Jap.* 333. *tab.* 35. *Linn. Suppl.* 445.

Obs. In the specimen communicated by Professor Thunberg himself, the stalk is scaly and rough, instead of being smooth as described in the *Flora Japonica*.

A native of Japan. *Thunberg.*

3. *W. virginica*, fronde pinnatâ : pinnis pinnatifidis nervo utrinque fructificante : lobis obtusis ferrulatis, stipite glabro.

Frond pinnated ; pinnæ pinnatifid, their main nerve with fructification along each side ; their lobes obtuse, minutely ferrated. Stalk smooth.

Blechnum virginicum. *Linn. Mant.* 307. *Ait. Hort. Kew.* v. 3. 460.

Filix mas vulgari similis, pinnulis amplioribus planis, nec crenatis,
virginica.

virginica. *Pluk. Phyt. t. 179. f. 2.*
bad.

A native of Virginia.

4. *W. radicans*, fronde pinnatâ : pin-
nis pinnatifidis nervo nudo : lobis
acutis ferratis, stipite glabro.

Frond pinnated ; pinnæ pinnatifid,
their main nerve destitute of fructi-
fication ; their lobes acute, serrated.
Stalk smooth.

Blechnum radicans. Linn. Mant.
307. (except the synonym of *Plu-*
kenet.) *Ait. Hort. Kew. v. 3. 460.*

Filix italica non ramosa maxima,
glabra, Polypodii folio, gallas ferens,
D. Michellii. Till. Pis. 62. t. 24.

A native of Madeira, in the deep
clayey fissures of rocks, *Kœ-*
nig ; in a valley between *Char-*
taria and *Ferrara, Tilli* ; in Por-
tugal, *Edward Whittaker Gray*
M. D.

9. PTERIS. *Linn. Fructif. in lineâ mar-*
ginali, continua.

R

Invo-

Involucrum e margine ipsius frondis inflexo, continuum, interius dehiscens.

Fructif. in an uninterrupted marginal line.

Involucrum from the margin of the frond turned in, uninterrupted, separating on the inner side.

Examples. *Pteris grandifolia* Linn.

- - vittata.

- - cretica.

- - aquilina.

To this genus are perhaps to be referred *Acrosticum septentrionale* and *A. australe* of Linn. as well as *A. australe* of Vahl's *Symbolæ* 1, tab. 25: which last has been better named, by Koenig, *A. radiatum*.

10. LINDSÆA. Dryander in Tr. of Linn. Soc. vol. 3. *Fructif.* in lineâ continuâ, à margine parùm remota.

Involucrum superficialium, continuum, exterius dehiscens.

Fructif.

Fructif. in an uninterrupted line, a little removed from the margin.

Involucrum originating from the surface, continued; separating outwards.

See tab. 1. fig. 4.

Examples.

Adiantum guianense Aublet's Guiana,
tab. 365.

- - - *sagittatum ditto, t. 366.*

- - - *strictum Swartz Prod. 135.*

II. VITTARIA. *Fructif.* in lineâ marginali, continuâ.

Involucrum duplex, continuum; *alterum* superficialium, exterius dehiscens; *aliud* e margine ipsius frondis inflexo, interius dehiscens.

Fructif. in an uninterrupted marginal line.

Involucrum double, uninterrupted; *one* from the surface, separating outwards; the *other* from the margin of the frond turned in, separating inwards.

See tab. 1. fig. 5.

R 2 *Example.*

Example. Pteris lineata Linn.

This I believe is the only species referable to this genus, among all the ferns hitherto discovered*.

12. LONCHITIS. Linn. *Fructif.* in lineolis, sinubus frondis geminatim subjectis, lunulatis.

Involucra e margine ipsius frondis inflexo, interius dehiscentia.

Fructif. in small lines, placed in pairs, forming a crescent, at each sinus of the frond.

Involucra from the margin of the frond turned in, separating inwards.

Obs. This genus agrees nearly with Pteris in habit, and with Adiantum in character. Lonchitis pedata of Linnæus and L. adscensionis of Forster are real species of Pteris.

* Notwithstanding which no genus can be more peculiar in habit, nor more certain in character.

Examples.

Examples. *Lonchitis hirsuta* Linn.

- - - aurita.

13. ADIANTUM. Linn. *Fruētif.* in punctis subrotundis, marginalibus, distinctis.

Involucra squamiformia, e margine ipsius frondis inflexo, distincta, interius dehiscentia.

Fruētif. in roundish, separate, marginal spots.

Involucra like scales, from the margin of the frond turned in, distinct, separating inwards.

Examples.

Adiantum Capillus Veneris Linn.

- - - triphyllum *Plant. Ic. ex Herb. Linn. tab. 74.*

14. DAVALLIA. *Fruētif.* in punctis subrotundis, submarginalibus, distinctis.

Involucra squamiformia, superficialia, distincta, exterius dehiscentia.

Fruētif. in roundish, separate spots, near the margin.

Involucra like scales, from the surface, distinct, separating outwards.

See tab. 1. fig 6.

OBS. The fructifications are, with respect to the veins, always terminal, by no means lateral. The habit of *Davallia* is firm, polished, and compact, far unlike the tender, membranous, expansive appearance of *Trichomanes* and *Adiantum*.

I have with the greatest pleasure dedicated this new genus to my amiable and intelligent friend Edmund Davall, Esq, F. L. S. resident at Orbe in Switzerland; a botanist no less indefatigable than acute.

Examples.

1. *D. canariensis*, fronde tripartita alternatim supradecomposita: laciniulis lanceolatis unifloris.

Fronde in three divisions, alternately thrice compounded; its ultimate divisions lanceolate and single-flowered.

Tricho-

Trichomanes canariense Linn. Ait.

H. Kew. vol. 3. 469.

A native of the Canary islands ;
also of the sides of mountains
in Portugal. *Læffling in the*
Linn. Herb.

2. *D. chinensis*, fronde alternatim tri-
pinnata : lacinulis cuneiformibus
obtusis sub-bifloris.

Fronde alternately thrice pinnated ;
its ultimate divisions wedge-shaped,
obtuse, and generally two-flowered.

Trichomanes chinense Linn.

A native of China.

3. *D. clavata*, fronde alternatim de-
composita : lacinulis lineari-cunei-
formibus obtusis unifloris.

Fronde alternately twice compound-
ed ; its ultimate divisions narrow,
wedge-shaped, obtuse, single-flow-
ered.

Adiantum clavatum Linn.

A native of the West Indian
islands.

4. *D. aculeata*, fronde supradecomposita: lacinulis cuneiformibus obtusis palmato-lobatis multifloris, rachi flexuosa aculeata.

Fronde thrice compounded; its ultimate divisions wedge-shaped, obtuse, palmato-lobate, many-flowered. Stalk zigzag and prickly.

Adiantum aculeatum Linn.

A native of Jamaica and Hispaniola.

5. *D. pedata*, fronde quinquangula trifida pinnatifida: laciniis apice multifloris.

Fronde pentagonal, three-cleft, and pinnatifid; segments with many flowers at the top.

Adiantum repens, Linn. *Suppl.* 446.

A native of the island of Mauritius.

Obs. As almost every species of this genus has creeping scaly roots, it becomes necessary to change the trivial name given to this by the younger Linnæus.

6. D.

6. *D. falcata*, fronde pinnata : pin-
nis lanceolatis subfalcatis undula-
tis multifloris basi inæqualiter cor-
datis.

Fronde pinnated ; pinnæ lanceolate,
somewhat sickle-shaped, undulated,
many-flowered, unequally heart-
shaped at the base.

Lonchitis glabra minor. *Plum.*
Fil. 48. t. 63.

A native of the Caribbee islands,
in woods, and about rivulets.

Plumier. It occurs in the
Linnæan herbarium without
name or place of growth.

7. *D. pectinata*, fronde lanceolata
pectinato-pinnatifida : laciniis ob-
tusis undulatis multifloris ; infimis
auriculatis semipinnatifide.

Fronde lanceolate pectinato-pinnati-
fid : segments obtuse, undulated,
many-flowered ; the lowermost
auricled and half-pinnated.

A native of the East Indies. *Mr.*
Hurlock, 1786, — Specimens,
which

which appear not to be specifically distinct, were gathered in Otaheite by Mr. Nelson. *Bank-
sian Herb.*

8. *D. heterophylla*, frondibus sterilibus simplicissimis ovato-lanceolatis acutis integerrimis; fertilibus lineari-lanceolatis sinuatis multifloris. Sterile fronds very simple, ovato-lanceolate, acute and entire; fertile ones linear-lanceolate, sinuated, many-flowered.

A native of the East Indies; in Nicobar and Sumatra. *Bank-
sian Herb.*

15. *DICKSONIA*. L'Heritier. *Fructif.* in punctis subrotundis, marginalibus, distinctis, prominentibus.

Involucrum duplex; *alterum* superficialium, exterius dehiscens; *aliud* e margine ipsius frondis inflexo, alterum amplectens, interius dehiscens.

Fructif. in roundish, marginal, distinct, prominent spots.

Invo-

Involucrum double; one from the surface, separating outwards; the other from the margin of the frond turned in, embracing the former, and separating inwards.

See tab. 1. fig. 7.

OBS. This genus agrees in habit with *Davallia*.

Examples.

Dicksonia arborescens Ait. Hort. Kew.
vol. 3, 469.

- - - *culcita* - - ditto.

16. CYATHEA. *Fructif.* sparsæ, subrotundæ, calyci hemisphærico, apice dehiscenti absque operculo, infidentes.

Fructif. scattered, roundish, standing in an hemispherical calyx, which bursts at the top without an operculum.

See Plumier's ferns, tab. 2.

Examples.

1. *C. horrida*, caudice aculeato; fronde bipinnata

bipinnata pinnatifida: laciniis acuminatis apice ferratis marginem versus floriferis basi venis anastomosantibus.

Trunk thorny: frond bipinnate and pinnatifid; its segments acuminate, ferrated at the tip, flowering near the margin, and furnished with interramifying veins at their base.

Polypodium horridum Linn. *Sp. Pl.* 1554.

A native of Hispaniola and Jamaica.

2. *C. multiflora*, caudice . . . fronde bipinnata pinnatifida: laciniis obtusis ferratis; rachi alata, floribus sparsis; calyce lacero.

Trunk (unknown): frond bipinnate and pinnatifid; its segments obtuse and ferrated; stalk winged. Flowers scattered. Calyx torn.

A native of Jamaica; communicated by sir Joseph Banks, bart.

3. *C. arborea*, caudice arboreo squa-
 moso; fronde bipinnata: pinnulis
 sessilibus ferratis basi multifloris,
 calyce integerrimo.

Trunk arborescent, scaly: frond
 bipinnate; leaflets sessile, ferrated,
 with many flowers at their base.

Calyx entire.

Polypodium arboreum Linn.

A native of Jamaica. *Mr. Eve-
 rard Home.*

4. *C. capensis*, fronde tripinnata: pin-
 nulis sessilibus acutis ferratis basi
 unifloris, calyce lacero.

Fronde tripinnate; leaflets sessile,
 acute, ferrated, bearing a solitary
 flower at their base. Calyx torn.

Polypodium capense Linn. *Suppl.*
 445.

Gathered at the Cape of Good
 Hope, by *Dr. Sparrman.*

5. *C. fragilis*, fronde bipinnata pin-
 natifida: laciniis obovatis incis; ;
 rachi alata, floribus sparsis, calyce
 lacero.

Fronde

Fronde bipinnate and pinnatifid; its segments obovate, notched; stalk winged. Flowers scattered. Calyx torn.

Polypodium fragile Linn.

A native of Europe, upon moist shady rocks*.

6. *C. montana*, fronde trifida bipinnata pinnatifida: laciniis subfalcatis apice dentatis; rachi alata, floribus sparsis, calyce lacero.

Fronde in three divisions, each bipinnate and pinnatifid; segments slightly crescent-shaped, dentated at the tip; stalk winged. Flowers scattered. Calyx torn.

Polypodium montanum, Allioni Flora Pedemont. No. 2410.

A native of the alps of Europe.

Obs. I suspect the *Polypodium alpinum* of Jacquin's *Collectanea*, vol. 2, 171, to belong to this genus,

* See *Cyathea incisa*, *Engl. Bot. tab. 163*, a species which requires farther investigation.

as specimens received from my friend Mr. Jacquin jun. do not well agree with the description given of the cover of their fructification by the celebrated Wulfen: these specimens however are not sufficiently perfect for me to determine the genus with certainty.

17. *TRICHOMANES* Linn. *Fructif.* margini frondis insertæ, distinctæ.

Involucra urceolata, monophylla, exterius hiantia.

Columellæ exsertæ, pistilliformes.

Fructif. inserted into the margin of the frond, separate.

Involucra urn-shaped, undivided, opening outwards.

Columns extending beyond the involucra, like styles.

See Plumier's Ferns, tab. 86.

OBS. The habit is membranaceous, and semitransparent.

Examples.

Trichomanes crispum Linn.

Tricho-

Trichomanes	scandens	Linn.	
- - - -	pufillum	Swartz	Prod.
- - - -	reptans	}	ejusd.
- - - -	lucens		
- - - -	rigidum		

18. HYMENOPHYLLUM. *Fructif.* margini frondis insertæ, distinctæ.

Involucra bivalvia, planiuscula, recta, exterius hiantia.

Columellæ inclusæ.

Fructif. inserted into the margin of the frond, separate.

Involucra of two flattish straight valves, opening outwards.

Columns shorter than the involucra.

See tab. 1. fig. 8.

OBS. This genus agrees in habit with *Trichomanes*.

Examples.

Trichomanes	Tunbridgense	Linn.*
- - - -	asplenoides	Swartz Prod.

* *Hymenophyllum Tunbridgense.* Eng. Bot. t. 162.

Trichomanes fucoides	} <i>Swartz Prod.</i>
- - - ciliatum	
- - - lineare	
- - - undulatum	
- - - polyanthos	
- - - clavatum	

also *Adiantum decurrens Jacq. Coll. v. 2. 103. tab. 2. f. 1 & 2*, but in this species the column appears to be longer than the involucre.

19. SCHIZÆA. *Fructif.* in appendiculo frondis, ejusdemque dorsum tegentes.

Involucra e marginibus appendiculi inflexis, continuis.

Fructif. upon an appendage to the frond, and covering its back.

Involucra from the margins of the appendage turned in, uninterrupted.

See tab. 1. fig. 9.

OBS. The habit of this genus is extremely distinct, though the characters are not so clear as in some

S

others.

others. The name is derived from
σχιζω, to cleave afunder.

Examples.

Acrostichum pectinatum *Linn.*

- - - dichotomum.

- - - elegans *Vahl. Symbol. 2.*
t. 50.

and perhaps spicatum *Linn.*—*Sm. Plant.*
Ic. t. 49.

SECTION II.

THECATÆ. *Capsules without rings.*

Essent. Char. Capsulæ sessiles, per foramina dehiscentes, absque annulo, nudæ.

Capsules sessile, bursting by pores, destitute of a ring, and naked.

20. GLEICHENIA. *Capsulæ* triloculares, trivalves; *dissepimenta* e medio valvularum.

Capsules with three cells and three valves;

valves; the *partitions* originating from the middle of each valve.

See tab. I. fig. 10.

OBS. Named in memory of William Frederick, Baron Gleichen, author of some microscopic observations on the parts of fructification of plants.

Example.

- I. Gl. *polypodioides*, the only species yet discovered.

Onoclea polypodioides Linn. *Mant.* 306.

A native of the Cape of Good Hope, (and of New South Wales).

21. MARATTIA. Swartz. *Capsulæ* ovales, supernè longitudinaliter dehiscentes; *loculis* utrinque pluribus.

Capsules oval, bursting longitudinally on their upper side; disclosing several *cells* in each division.

Examples.

Marattia alata Swartz *Prod.* 128. *Sm. Plant. Ic. t.* 46.

Marattia lævis *Pl. Ic. t. 47.*

- - - fraxinea *ibid. t. 48.*

22. DANÆA. *Capsulæ* uniloculares, extus poro dehiscentes, duplici serie aggregatæ.

Capsules of one cell, bursting by a pore on the outside, accumulated together in two parallel rows.

See tab. 1. fig. 11.

OBS. I have named this genus in honour of my much respected friend and correspondent Dr. Peter Maria Dana of Turin, whose name has long ago been given, by the celebrated Professor Allioni, to a plant which appears to me a species of *Ligusticum*.

The capsules of *Danæa* (and indeed of *Marattia*) stand upon small veins.

Examples.

1. *D. nodosa*, rachi subsimplici; foliis acuminatis subintegerrimis ad marginem usque capsuliferis, stipulis acutis.

Stalk scarcely winged; leaflets pointed, nearly entire, covered with capules to the very edge. Stipulæ acute.

Asplenium nodosum Linn.

Lingua cervina nodosa major. Plum.

Filices 90, t. 108.

A native of Jamaica, Hispaniola, and Martinique, in moist shady places.

2. *D. alata*, rachi apice alata; foliolis ferrulatis prope marginem nudis, stipulis obtusis eros.

Stalk winged towards the top; leaflets ferrulated, bare of fructification near the margin. Stipulæ obtuse and jagged.

Lingua cervina nodosa minor. Plum.

Filices 91, t. 109.

A native of Martinique.

EXPLANATION OF TABLE I.

Fig. 1. *Hemionitis plantaginea*.

- a. A portion of the frond, of its natural size.

S 3

b. Fruc-

- b. Fructification magnified.
- c. Rings of the capsules.

Fig. 2. *Scolopendrium vulgare*.

A portion of the frond, of its natural size, with the fructification in its proper situation, the involucre being already separated.

Fig. 3. *Woodwardia radicans*.

- d. A segment of the frond.
- e. Part of the same magnified.
- f. Involucrum.

Fig. 4. *Lindsæa*, probably a new species.

- g. A pinna.
- h. Part of the same enlarged.
- i. Involucrum.
- k. Cluster of capsules.

Fig. 5. *Vittaria lineata*.

- l. Part of the frond.
- m. A lesser portion magnified.
- n. Involucra.

Fig. 6. *Davallia canariensis*.

- o. A pinnule.
- p. The same enlarged.
- q. Involucrum.

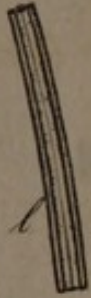
Fig.



2. *Scolopendrium.*



fig. *Hemionitis.*



5. *Vittaria.*



4. *Lindsaea.*



3. *Woodwardia.*



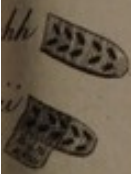
8. *Hymenophyllum.*



7. *Dicksonia.*



6. *Davallia.*



11. *Danaea.*



10. *Gleichenia.*



9. *Schizaea.*

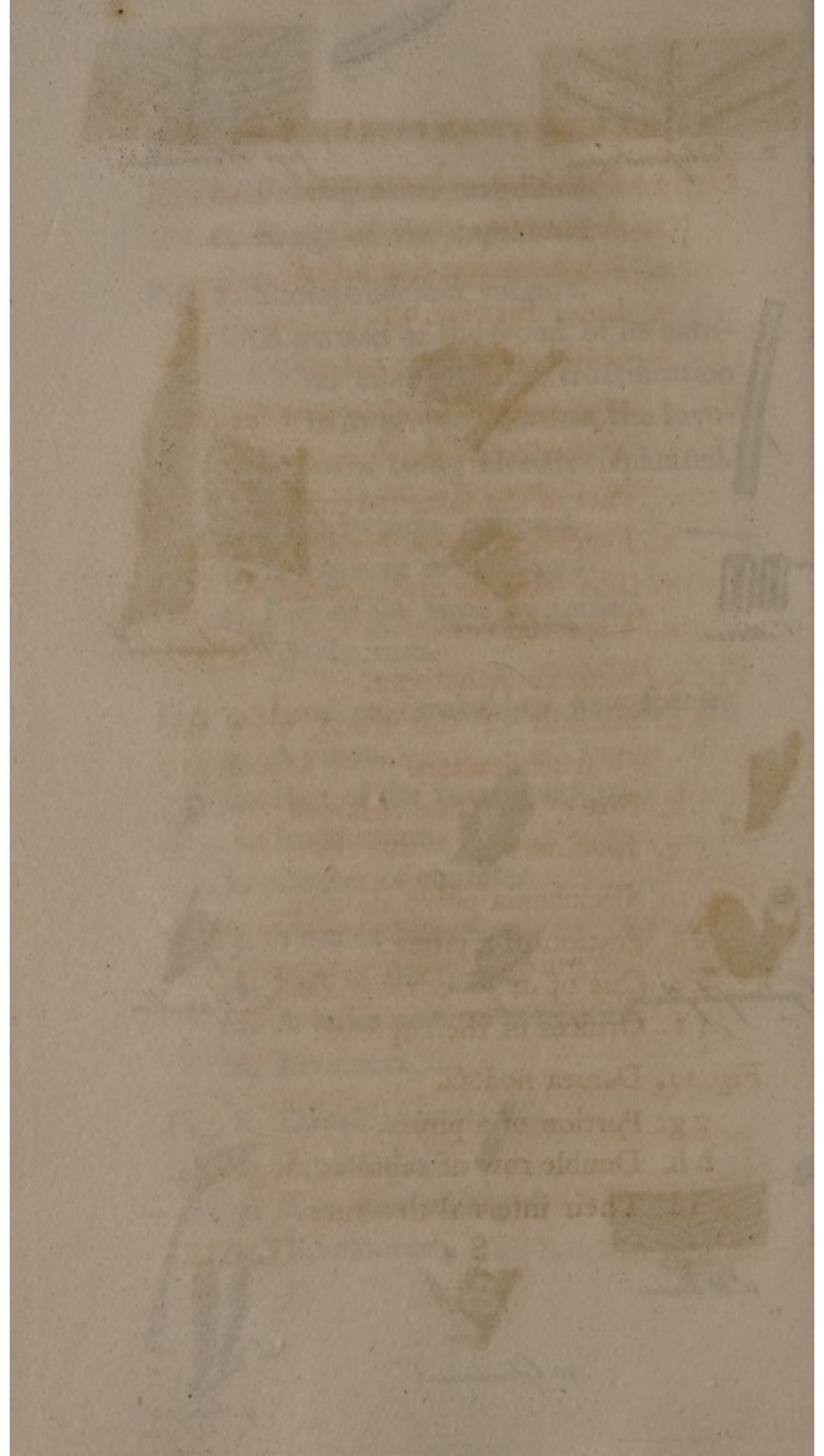


Fig. 7. *Dicksonia arborescens*.

- r. A pinnula.
- s. Fructification magnified.
- t. Inner Involucrum.
- u. Outer do.

Fig. 8. *Hymenophyllum*—a new species?

- v. A portion of the frond.
- w. Part of the same magnified.
- x. Fructification in its natural state.
- y. The same forcibly expanded.
- z. Capsules.

Fig. 9. *Schizæa dichotoma*.

- a a. Summit of the frond, with the fructification.
- b b. Part of the same enlarged.
- c c. Involucrum.

Fig. 10. *Gleichenia polypodioides*.

- d d. Portion of a pinna.
- e e. One of its lobes magnified.
- f f. Orifices of the capsules.

Fig. 11. *Danæa nodosa*.

- g g. Portion of a pinna.
- h h. Double row of capsules magnified.
- i i. Their internal structure.

Fig. 7. *Dicksonia arborescens*.

a. A pinna.

b. Fructification magnified.

c. Inner involucre.

d. Outer do.

Fig. 8. *Hymenophyllum*—a new species?

a. A portion of the frond.

b. Part of the same magnified.

c. Fructification in its natural state.

d. The same forcibly expanded.

e. Capsules.

Fig. 9. *Schizox dichotoma*.

a. Summit of the frond, with the

fructification.

b. Part of the same enlarged.

c. Involucre.

Fig. 10. *Gleichenia polypodoides*.

a. Portion of a pinna.

b. One of its lobes magnified.

c. Orifices of the capsules.

Fig. 11. *Danaea nodosa*.

a. Portion of a pinna.

b. Double row of capsules magnified.

c. Their internal structure.

X.

DESCRIPTION

OF

A NEW GENUS OF PLANTS

CALLED

SPRENGELIA.

*First published in Swedish in the Transactions of the Royal
Academy of Sciences at Stockholm for 1794, p. 260, tab. 8.*

X

DESCRIPTION

OF

A NEW GENUS OF PLANTS

CALLED

SPRENGELIA.

This publication is thought to be the property of the Royal
Academy of Sciences at Stockholm for 1794, p. 160, tab. 8.

[Faint, illegible text, likely bleed-through from the reverse side of the page.]

DESCRIPTION

OR

A NEW GENUS OF PLANTS

CALLED

SPRENGELIA.

AMONG the many new genera, and even new natural orders, of vegetables, which have lately been brought from New South Wales to England, scarcely any is more elegant in appearance, or more numerous in species, than the tribe to which belongs the genus of *Epacris*, Linn. Suppl. 19. & 138. This genus was first established by the celebrated Forster; but even he, as well as the younger Linnæus, have confounded two genera under it, among the very few species they have enumerated. These are

EPACRIS,

EPACRIS, *Gærtner Sem. v. 2. 77. t. 94, f. 1.*

Capsula 5-locularis, 5-valvis, dissepimentis e medio valvularum. *Semina* acerofa, plurima.

Capsule with five cells and five valves; partitions from the middle of the valves. *Seeds* several, chaffy.—

and ARDISIA, *Ibid. 78, t. 94, f. 2.*

Drupa 5-locularis. *Semina* bina.

Drupa with five cells. *Seeds* two in each cell.

The last genus however, of which I am acquainted with a considerable number of species, must not be called *Ardisia*, as Dr. Swartz in his *Prodromus*, and the late Mr. Aiton in his *Hortus Kewensis*, have been beforehand with Gærtner in applying that name to a very different genus. I propose therefore to call the *Ardisia* of Gærtner, *Styphelia*, a name given to it originally by Dr. Solander*.

The subject of our present more immediate consideration is a very distinct genus

* It is now published by that name in the 4th Number of the New Holl. Bot. t. 14,

from both the above, though of the same natural order. I have named it *Sprengelia*, in honour of Mr. *Christian Conrad Sprengel*, master of a grammar school (*Rektor Scholæ*) at Spandow in Brandenburg, who has richly deserved to be commemorated as a botanist, by his very ingenious work on the manner in which insects promote the impregnation of plants, printed at Berlin in 1793; and if one genus can be more proper to bear his name than another, it must be one marked with some peculiarity in the organs of impregnation. Accordingly the genus I have chosen for the purpose is distinguished from all the rest of its natural order, by having its *antheræ* united into a tube.

SPRENGELIA.

PENTANDRIA *Monogynia*.*Essential Character.*

Calyx quinquepartitus, persistens. *Petalata* quinque. *Stamina* receptaculo inserta. *Antheræ* connatæ. *Capsula* quinque-

quinquelocularis, quinquevalvis; dissepimentis e medio valvularum.

Calyx in five divisions, permanent. *Petals* five. *Stamina* inserted into the receptacle. *Antheræ* united. *Capsule* with five cells, and five valves; partitions from the middle of the valves.

Natural Character.

Calyx a part of the flower, in five deep divisions, so as to be almost composed of five leaves, chaffy, coloured, permanent; *segments* equal, lanceolate, acute, concave; after flowering erect and closed together.

Petals five, about as long as the calyx, lanceolate, acute, cohering a little way above the base, in the upper part spreading, and assuming the appearance of a wheel-shaped corolla; after flowering erect and closed together, soon falling off. I have discovered no *Nectary*.

Stamina five, the length of the petals;

filaments inserted into the receptacle, distinct, linear, flat, equal, smooth; *antheræ* vertical, united into a tube, clothed externally with numerous yellow club-shaped hairs.

Pistillum; *germen* superior, roundish, depressed, with five furrows, smooth; *style* simple, about equal to the top of the *antheræ*; *stigma* simple, obtuse.

Capsule somewhat cylindrical, obtuse, with five furrows, separating in the upper part into five valves; *partitions* longitudinal, arising from the middle of each valve; *column* a little rugged, shorter than the valves.

Seeds numerous, roundish, minute.

According to the ancient system of Linnæus this genus should be placed in his *Syngenesia Monogamia*. But although I by no means assent to all the late innovations which have been made in that system, I cannot but think the *order* just mentioned had better be abolished, and would therefore place *Sprengelia* in *Pentandria*

tandria Monogynia, near *Azalea*, along with *Styphelia* and *Epacris*. From the last it is clearly distinguished by its five petals, its connected antheræ, and the insertion of its stamina into the receptacle, not into the corolla; in all which particulars it also differs from *Styphelia*, as well as in the structure of its fruit.

One species only has hitherto come to our knowledge,

SPRENGELIA incarnata.

This is a *shrub*, about two feet high, much branched, rigid, very smooth, flowering copiously. *Wood* hard, white. *Branches* round, wavy, leafy. *Bark* brown, cracked when old.

Leaves alternate, sometimes imbricated in three ranks, embracing the stem, spreading very much, lanceolate, acute, entire, concave, a little glaucous, without veins, rigid and projecting, remaining (though faded) through the winter, and at length being loosened

ened at the base, they may be turned round into any position.

Stipulæ none.

Flowers terminal, clustered, on flower-stalks, pale red.

Flower-stalks clothed with imbricated *bractææ* like the leaves, but smaller, and with a membranous and ciliated margin, clustered under each flower.

Calyx rose-coloured, very rarely a little downy on the outside.

Corolla flesh-coloured.

The dried leaves of this plant possess a slight degree of astringency, but of its use or properties I have no account. The tribe to which it belongs seems to occupy the same place in the scale of Nature at New Holland, as the genus of *Erica* does at the Cape of Good Hope; and they agree with the last-mentioned genus very much in habit and appearance, though essentially different in botanical characters. We scarcely know enough of them yet to decide whether Monf. de Jussieu has done

T

right

right in referring *Epacris* to his natural order of ERICÆ, *Juss. Gen. Pl.* 159, or whether the plants in question ought to constitute a new one.

Instead of the uncoloured figure, drawn from a dried specimen, published in the Stockholm Transactions, I have substituted one taken by Mr. Sowerby from a living plant, which flowered in April 1795, in the choice collection of George Hibbert Esq. F. L. S. at Clapham. I have since repeatedly examined the flowers at Messrs. Lee and Kennedy's, Hammer-smith.

TAB. 2. fig. 1. represents a branch of *Sprengelia incarnata* of the natural size.

2. Front of a flower.
3. Back of the same.
4. *Petals* in their natural state, cohering at the base.
5. Organs of fructification.
6. The same magnified.
7. *Germen* and *style*.
8. The same magnified.



Sprengelia incarnata.

XI

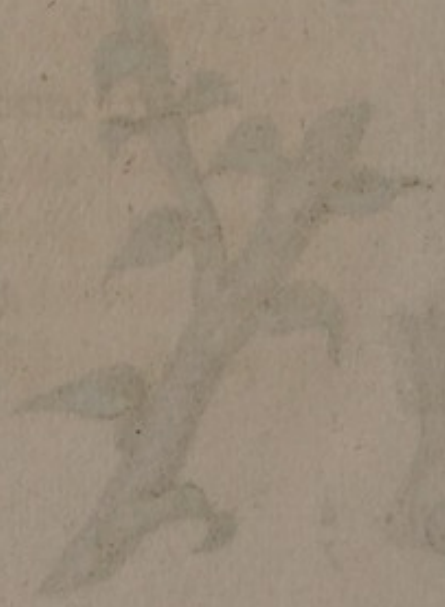
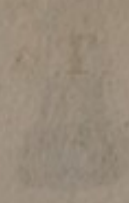
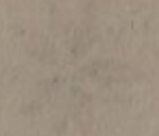
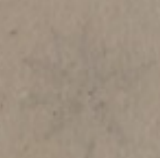
DESCRIPTION

A NEW GENUS OF PLANTS

called

WESTRINGIA.

Communicated to the Royal Academy of Sciences at Stockholm.



XI.

DESCRIPTION
OF
A NEW GENUS OF PLANTS
CALLED
WESTRINGIA.

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DESCRIPTION

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A NEW GENUS OF PLANTS

DESCRIPTION

WESTRINGIA.

A NEW GENUS OF PLANTS

THE order of *Dryandra* ^{called} *Gymnospermia*
 in the Linnæan system is almost perfectly
 a natural one. **WESTRINGIA.** Plants that
 ought not, according to any system, to be
 distinguished as a distinct order of *Sida* at all.
 I have invented that some genera, which naturally
 belong to this order, but have only two
 stamens, have necessarily, according to the
 artificial system of Linnæus, been sep-
 arated from it, and placed in his class *D.*
and. I have here inserted one of those
 vulgar objections to his system, which any
 person

bottom who can count from two to four
might make, and which is therefore made

DESCRIPTION

that Linnæus intended his system should

be convenient and easy, rather than natu-

ral; and that it is, notwithstanding, much

A NEW GENUS OF PLANTS

that has yet been discovered. He by no

means intended to prevent an en-

quiry into the true arrangement of Na-

WESTRINGIA.

held out as the great object of philo-

topical botany.

THE order of *Didynamia Gymnospermia* in the Linnæan system is almost perfectly a natural one, containing no plants that ought not, according to any system, to be arranged together. It is only to be lamented that some genera, which naturally belong to this order, but have only two stamina, have necessarily, according to the artificial system of Linnæus, been separated from it, and placed in his class *Diandria*. Hence has arisen one of those vulgar objections to his system, which any

person who can count from two to four might make, and which is therefore made every day. A sufficient answer to such is, that Linnæus intended his system should be convenient and easy, rather than natural; and that it is, notwithstanding, much more natural than any system equally easy that has yet been discovered. He by no means intended it should prevent an enquiry into the true arrangement of Nature, which, on the contrary, he always held out as the great *desideratum* of philosophical botany.

But while I thus presume to offer an apology for our great master, I must beg leave in some particulars to dissent from him. Perhaps *Verbena*, on account of the majority of its species being truly *tetrandrous*, might be much more commodiously placed in *Didynamia*; as might *Cunila* also, if it ought to be suffered to remain as a genus at all, being made up of *Thymi* and *Saturejæ* chiefly, which happen to have two of their stamina abortive, but have few characters in common besides.

The

The plant of which I shall now attempt a description was, when first discovered in New Holland, called by Dr. Solander *Cunila fruticosa*, because it answers to the character of that genus as defined by Linnæus. Nevertheless, I cannot help dissenting from this great authority, as the plant in question is totally different in habit from every *Cunila*, bearing a much greater resemblance at first sight, though not on accurate examination, to *Rosmarinus*. This want of agreement in habit made me sedulously examine the flower, and I flatter myself the following characters will clearly establish it as a new genus.

WESTRINGIA.

Didynamia Gymnospermia.

Essential Character.

Calyx semiquinquefidus, pentagonus.

Corolla resupinata : limbo quadrifido ;
lobo longiori erecto, bipartito.

Stamina distantia ; duo breviora (inferiora) abortiva.

T 4

Calyx

Calyx five-cleft half way down, five-sided. *Corolla* reversed: limb in four segments; the longest erect, cloven.

Stamina distant; the two shorter, or lowermost, abortive.

Natural Character.

Calyx a part of the flower, permanent, of one leaf, of a tubular bell-shape, with five sides, and five prominent angles, without any furrows or *striae*, divided about half way to the base into five equal, erect, lanceolate, beardless segments.

Corolla of one petal, ringent, twice as long as the calyx, reversed: *tube* the length of the calyx, with a hairy orifice: *limb* in four lobes; the *upper lip* a little the longest, erect, cloven half way down; the *lower* in three deep equal segments, which are divaricated, of a linear oblong form.

Stamina four, about half as long as the limb, spreading; the two lowermost shorter than the others, and most frequently

quently abortive; *antheræ* roundish, two-lobed, incumbent.

Pistillum: *germen* four-lobed; *style* thread-shaped, the length of the *stamina*; *stigma* cloven, small.

Seeds four, naked, obovate.

I would place this genus in *Didynamia* *Gymnospermia* after *Teucrium*, rather than in *Diandria*, because it has four *stamina*, two of which are shorter than the others; and though generally (not always) their *antheræ* are abortive, they are nevertheless always present. These two shorter *stamina* are the lowermost. The flower is *resupinate* or reversed. It belongs to the first section of M. de Jussieu's *Labiatae*.

The name is given in honour of Mr. John Peter Westring, author of a Dissertation on the *Lichen* tribe, and their uses in dyeing, printed in the Transactions of the Stockholm Academy for 1794.

The only species of *Westringia* I have seen is a native of New South Wales, near Port Jackson, and has flowered several times in the English green-houses.

WESTRINGIA *rosmariniformis*.

A *shrub* very much branched; the branches either opposite or four together, square, filky, leafy.

Leaves in fours, on footstalks, spreading, linear-lanceolate, entire, revolute, rather pointed; of a bright shining green above, and almost naked; clothed with white filky down beneath.

Footstalks very short, filky. *Stipulae* none.

Flowers from the upper part of the branches, axillary, solitary, on short flower-stalks.

Braeteae a pair at the base of the *calyx*, linear, short, filky.

Calyx filky, its segments naked, with revolute margins.

Corolla white, with purple spots about the orifice.

We are not informed of any particular qualities in this shrub. The leaves are
slightly

WESTRINGIA

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Leaves in fours, on footstalks, spreading,
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rather pointed, of a bright shining
green above, and almost naked;
clothed with white silky down be-
neath.

Footstalks very short, silky. Stipules
none.

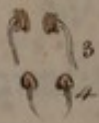
Flowers from the upper part of the
branches, axillary, solitary, on short
flower-stalks.

Bud a pair at the base of the calyx,
linear, short, silky.

Calyx silky, its segments naked, with
revolute margins.

Corolla white, with purple spots about
the orifice.

We are not informed of any particular
products in this shrub. The leaves are
slightly



Westringia rosmariniformis.



slightly bitter, not aromatic; the flowers not inelegant, though without smell.

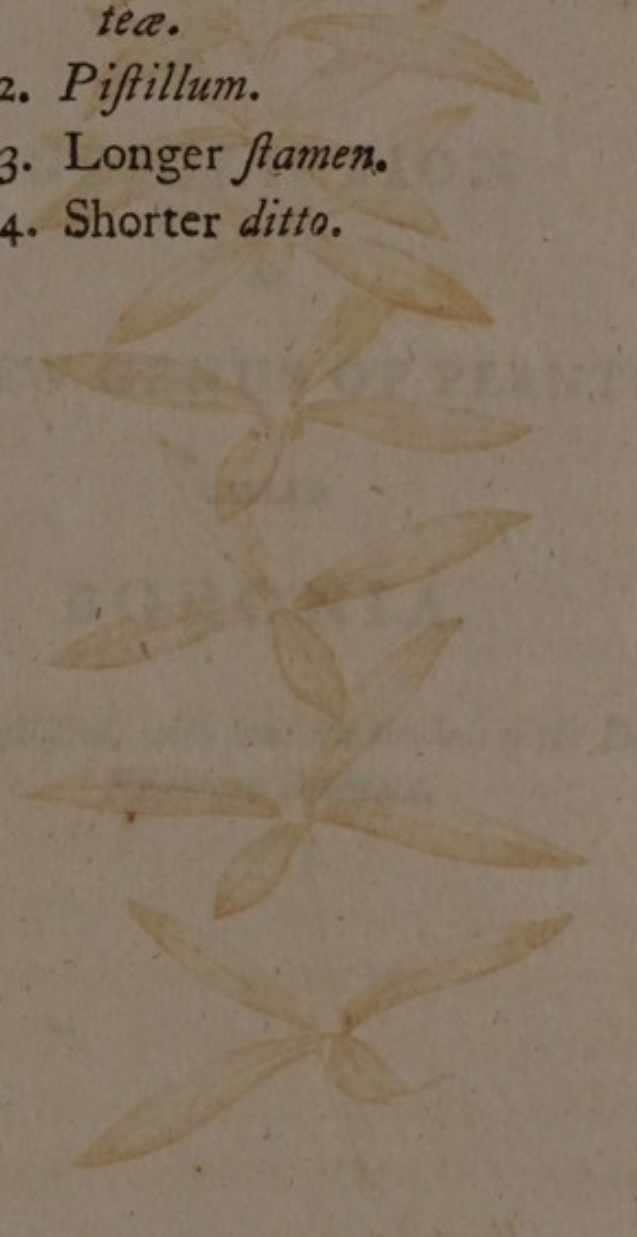
TAB. 3 represents a branch of *Westringia rosmariniformis*, of the natural size.

Fig. 1. Calyx accompanied by the *bracteæ*.

2. *Pistillum*.

3. Longer *stamen*.

4. Shorter *ditto*.



PLANTS CALLED WESTINDIA. 283

slightly bitter, not aromatic; the flowers
not elegant, though without smell.

TAB. 3 represents a branch of Westindia-
gia rosmarinifera, of the natural size.

Fig. 1. Calyx expanded by the pres-

sure.

2. Pistil.

3. REPERITION

4. Short ditto.

or

A NEW GENUS OF PLANTS

CALLED

BORONIA.

Now first published, with four Particulars of the Death of
FRANCIS BORONIA.

XII.

DESCRIPTION

OF

A NEW GENUS OF PLANTS

CALLED

BORONIA.

*New first published, with some Particulars of the Death of
FRANCIS BORONE.*

DESCRIPTION

XII
A NEW GENUS OF PLANTS

CALLID

DESCRIPTION

BORONIA.

A NEW GENUS OF PLANTS

THE country of New Holland, so rich
 in botanical novelties, has made us ac-
 quainted with several new genera of M.
 de Jussieu's natural order of Rutaceae,
 which promise to contribute very consi-
 derably to the ornament of our green-
 houses. These plants are in many re-
 spects allied to *Diosma*, and like that ge-
 nus their flowers are beautiful, and their
 foliage highly aromatic, though not always
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 nus among the whole tribe is more worthy

DESCRIPTION

OF

A NEW GENUS OF PLANTS

CALLED

BORONIA.

THE country of New Holland, so rich in botanical novelties, has made us acquainted with several new genera of M. de Jussieu's natural order of *Rutaceæ*, which promise to contribute very considerably to the ornament of our green-houses. These plants are in many respects allied to *Diosma*, and like that genus their flowers are beautiful, and their foliage highly aromatic, though not always pleasantly so. In some instances the scent of the flowers is very agreeable. No genus among the whole tribe is more worthy

of notice than that to which I have given the name of *Boronia*, the characters of which are as follows:

BORONIA.

OCTANDRIA *Monogynia*. Flowers complete.

Essential Character.

Calyx quadripartitus. *Petala* 4. *Antheræ* infra apicem filamentorum pedicellatæ. *Stylus* ex apice germinis, brevissimus. *Stigma* capitatum. *Capsulæ* 4, coalitæ. *Semina* arillata.

Calyx in four divisions. *Petals* four. *Antheræ* on footstalks, below the summits of the filaments. *Style* from the top of the germen, very short. *Stigma* capitate. *Capsules* four, united. *Seeds* tunicated.

Natural Character.

Calyx in four deep equal divisions, permanent.

Petals four, equal, alternate with the calyx and much longer, sessile, permanent.

manent. *Nectary* a glandular ring, surrounding the base of the germen.

Stamina eight, permanent, shorter than the corolla, and four of them a little shorter than the rest; *filaments* inserted into the receptacle, flat, tapering, ciliated, terminating variously; *antheræ* on short footstalks, inserted on the inside below the summit of the filament, two-celled, incumbent.

Pistillum; *germen* superior, standing upon the nectary, conical, with four furrows; *style* vertical, short; *stigma* roundish, smooth, with four furrows.

Capsules four, at first united, but soon separating, each of them compressed, of one cell and two equal valves, lined with a bivalve elastic *arillus*.

Seeds one or two in each capsule, compressed, smooth, shining.

Boronia is most allied to *Dictamnus* and *Diosma*, but the leaves of every species being opposite, prevent its being arranged near the former, as the order is now sub-

divided in M. de Jussieu's work. In fact a much better distribution of these genera may probably be contrived when more of them are discovered and defined.

Four species only of the genus in question have hitherto been detected among the dried specimens collected near Port-Jackson, by Mr. White; and only one of those, the *Boronia pinnata*, has been introduced into our gardens.

I. *BORONIA pinnata*.

Hawthorn-scented Boronia.

Foliis impari-pinnatis integerrimis, pedunculis axillaribus dichotomis, filamentis apice obtusis glandulosis.

Leaves abruptly pinnate, entire. Flower-stalks axillary, forked. Summit of the filaments obtuse and glandular.

A smooth shrub, near two feet high, with many wand-like, roundish, leafy branches.

Leaves opposite, rarely three together, without

without *stipulæ*, composed of from three to five pair of sessile, lanceolate, pointed, entire, smooth, somewhat succulent leaflets, with a terminal one like the rest, though often rather smaller; the common leaf-stalk is jointed, channelled and winged.

The elegant *flowers* arise from the bosoms of several of the uppermost leaves, in solitary corymbose forked clusters, and are of a rose colour, smelling like Hawthorn blossoms.

Stalks angular, with a pair of small acute *bractææ* at each divarication.

Calyx small, reddish, smooth.

Petals four times as long as the calyx, spreading, darker on the outside, slightly acid.

Filaments red, fringed with white hairs to the very top, which terminates in a blunt glandular protuberance, sometimes slightly hairy also, into the base of which on the inside is inserted a slender short smooth little footstalk, bearing the *anthera*, which is oval,

smooth, incumbent, bursting by two longitudinal fissures on the under side.

Germen small, smooth, four-lobed; *style* short, hairy; *stigma* blunt, with four furrows.

Capsules smooth.

Seeds solitary, black, enclosed in a white polished two-valved elastic case.

This species flowered for the first time in Europe at Messrs. Lee and Kennedy's, in the Spring of 1795. It continues there in a flourishing state, being treated as a rather tender green-house plant.

TAB. 4 represents the *Boronia pinnata*.

Fig. 1, Calyx. 2, Petal. 3, Stamen.

4, The same magnified. 5, Germen.

6, The same magnified, standing on

the nectary. 7, Capsules. 8, Aril-

lus. 9, Seed.

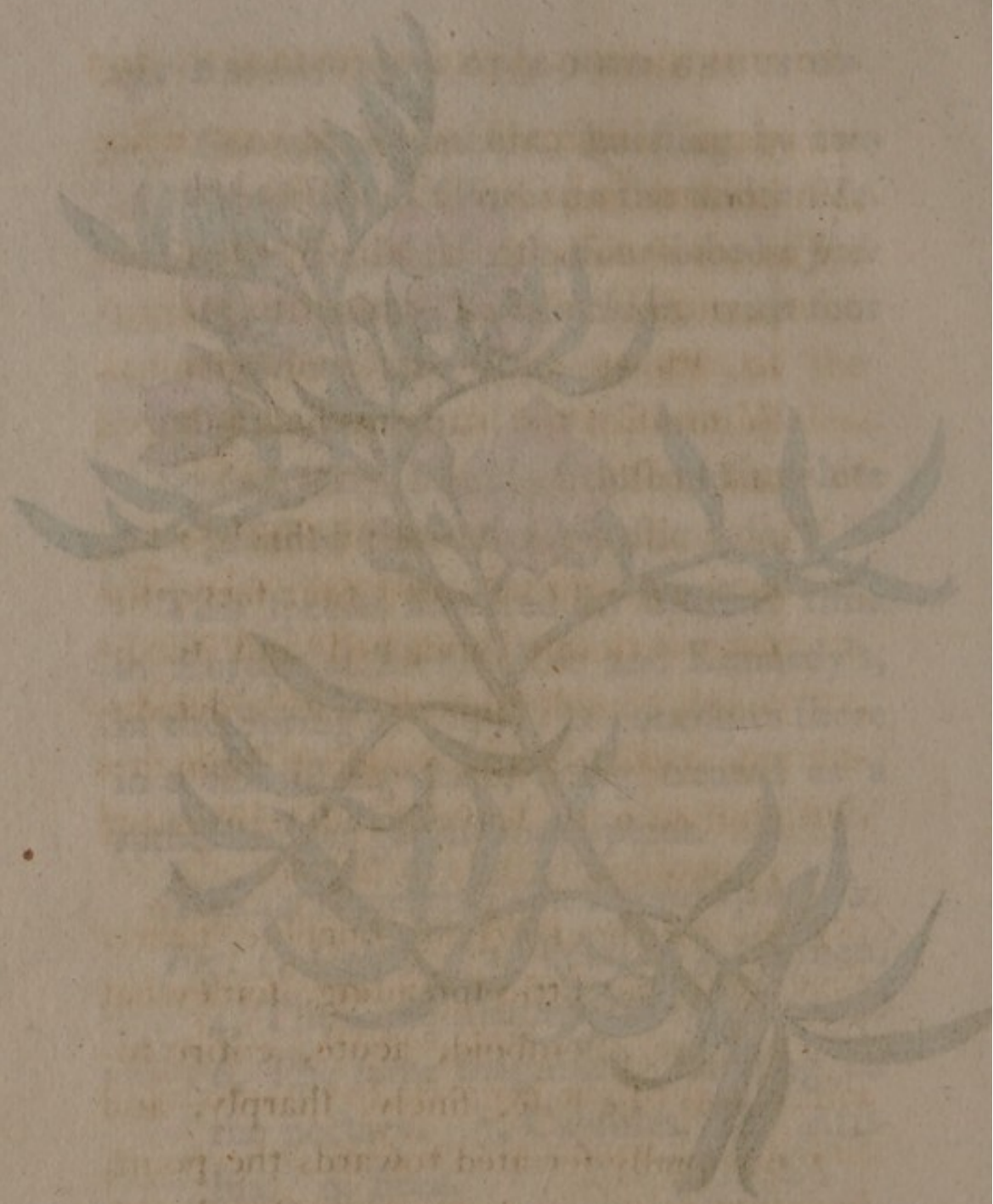
II. BORONIA *ferrulata*.

Rose-scented Boronia.

Foliis trapeziformibus acutis antice inæqualiter ferrulatis, pedunculis aggregatis



Boronia pinnata.



The leaves are linear-lanceolate, acute, glabrous, with a thin
 midrib, and a sharp, thin, white, serrated margin. The
 sheath is glabrous, with a thin, white, serrated margin.
 The panicle is terminal, branched, and glabrous. The
 spikelets are small, and the flowers are small and
 tubular. The fruit is a small, rounded, ribbed
 caryopsis, with a thin, white, serrated margin.
 The color of the fruit is a fine green, and
 the color of the spikelets is a purple tinged
 yellow. The flowers are small and tubular.

Stenandrium

gatis terminalibus, filamentis apice cordatis hispidis.

Leaves rhomboid, acute; in the upper part minutely and unequally serrated. Flower-stalks clustered, terminal. Summit of the filaments heart-shaped and bristly.

This is also a very beautiful shrub, rising to the height of about four feet; the stem variously branched and subdivided, round, smooth, with a deciduous cuticle; the younger branches clothed with leaves, and terminated by flowers.

Leaves without *stipulae*, opposite, nearly sessile, but little spreading, somewhat oblique, rhomboid, acute, entire towards the base, finely, sharply, and unequally serrated towards the point, without vein or nerve, punctated with resinous dots, aromatic, with a smell approaching to that of turpentine. Their colour is a fine green, often with a purplish tinge.

Flowers in little terminal somewhat corymbose clusters, of a beautiful red, and with the scent of a rose, as we are informed by Mr. White, who mentions this shrub as one of the most admired in New South Wales.

They are a little larger than those of *Boronia pinnata*.

Braçtææ opposite, lanceolate, concave, acute, often pubescent in the margin.

Calyx red; its segments ovate, acute, slightly carinated and ribbed, permanent, the two opposite ones external, the margin of all slightly downy.

Petals thrice as long as the calyx, spreading, ovate, rose-coloured with darker stripes, acid.

Filaments red, fringed with white hairs at the base, more naked above, but terminating in a globular notched protuberance, (less conspicuous in the four shorter stamina) which is thickly covered with white projecting hairs or bristles, the *antheræ* being inserted

on

184
The first part of the paper is devoted to a description of the
method used for the determination of the critical temperature
of the system. The results are given in Table I. It is seen
that the critical temperature increases with increasing
concentration of the polymer. This is to be expected since
the polymer chains are more closely packed and the
intermolecular forces are stronger. The critical temperature
is also affected by the nature of the solvent. The critical
temperature is higher for a good solvent than for a poor
solvent. This is because the polymer chains are more
solvated in a good solvent and the intermolecular forces
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high content of the high molecular weight component than
for a copolymer with a low content of the high molecular
weight component. This is because the high molecular
weight component is more closely packed and the
intermolecular forces are stronger.



Boronia serrulata.

on footstalks just below it, and shaped as in the preceding species.

Germen small, four-lobed; *stigma* nearly sessile, large, conical, blunt, smooth, slightly four-lobed.

Capsules smooth, sprinkled with resinous dots.

Seeds two in each case, of a shining black.

TAB. 5. *Boronia ferrulata.*

Fig. 1, Back of a flower. 2, Bractææ, 3, Petal. 4, Stamina. 5, 6, Longer and shorter stamina magnified. 7, Pistillum. 8, The same magnified. 9, Ripe fruit. 10, A capsule separate. 11, Seed.

III. BORONIA *parviflora.*

Pale-flowered Boronia.

Foliis obovato-lanceolatis obsoletè crenatis, pedunculis aggregatis terminalibus unifloris, filamentis apice oblongis glandulosis.

Leaves obovato-lanceolate, obscurely

crenate. Flower-stalks clustered, single-flowered, terminal. Summit of the filaments oblong and glandular. Much smaller in all its parts than the preceding, and by far less ornamental. *Branches* round, smooth, naked below; the younger ones leafy, and terminated by three or five flowers.

Leaves opposite, nearly sessile, without *stipulæ*, obovate, varying in breadth so as to be sometimes almost lanceolate, acute, very slightly crenate, somewhat succulent, smooth, without veins, dotted with resinous points, a little aromatic.

Flowers small, on smooth, simple, single-flowered, angular, club-shaped stalks, three together at the summit of each branch, and sometimes one in each of the bosoms of the two neighbouring leaves. *Braçtææ*, two or four at the common base of the flower-stalks, ovate, concave, smooth.

Calyx red or purplish, smooth.

Petals hardly twice as long as the calyx, obovate,

[Faint, mirrored text from the reverse side of the page, likely bleed-through from a botanical description.]

Fls. hardly twice as long as the calyx.
obovate



Boronia parviflora
Summit
leaves linear-lanceolate entire. flowers
axillary, solitary, single-flowered.
obtus. base
the flowers are small, white or pinkish
the leaves are small, linear-lanceolate
the stem is woody, and the flowers are
small, solitary, and single-flowered.



Boronia parviflora.

obovate, acute, white, with a reddish central stripe.

Filaments red, fringed with white hairs, terminating in a small, oblong, obtuse, somewhat glandular, but not hairy, appendage, rising above the insertion of the *antheræ*.

Germen deeply four-lobed, red; *style* very short and thick; *stigma* small, roundish, with four furrows.

TAB. 6. *Boronia parviflora*.

Fig. 1, Calyx and bractæ. 2, Petal. 3, Stamen magnified. 4, Germen and style magnified. 5, Capsules, natural size. 6, Arillus. 7, Seed.

IV. BORONIA *polygalifolia*.

Milkwort-leaved Boronia.

Foliis lineari-lanceolatis integerrimis pedunculis axillaribus solitariis unifloris, filamentis apice abbreviatis obtusis.

Leaves linear-lanceolate entire. Flower-stalks axillary, solitary, single-flowered.

Summit

Summit of the filaments short and blunt.

The woody perennial *root* throws up many herbaceous, simple (rarely branched), smooth, slightly angular, leafy *stems*, about six inches high and upright.

Leaves opposite (some of them very rarely alternate, or sometimes three together), almost sessile, spreading, an inch long, linear-lanceolate, acute, entire, smooth, dotted, paler beneath, with one central rib. *Stipulae* none.

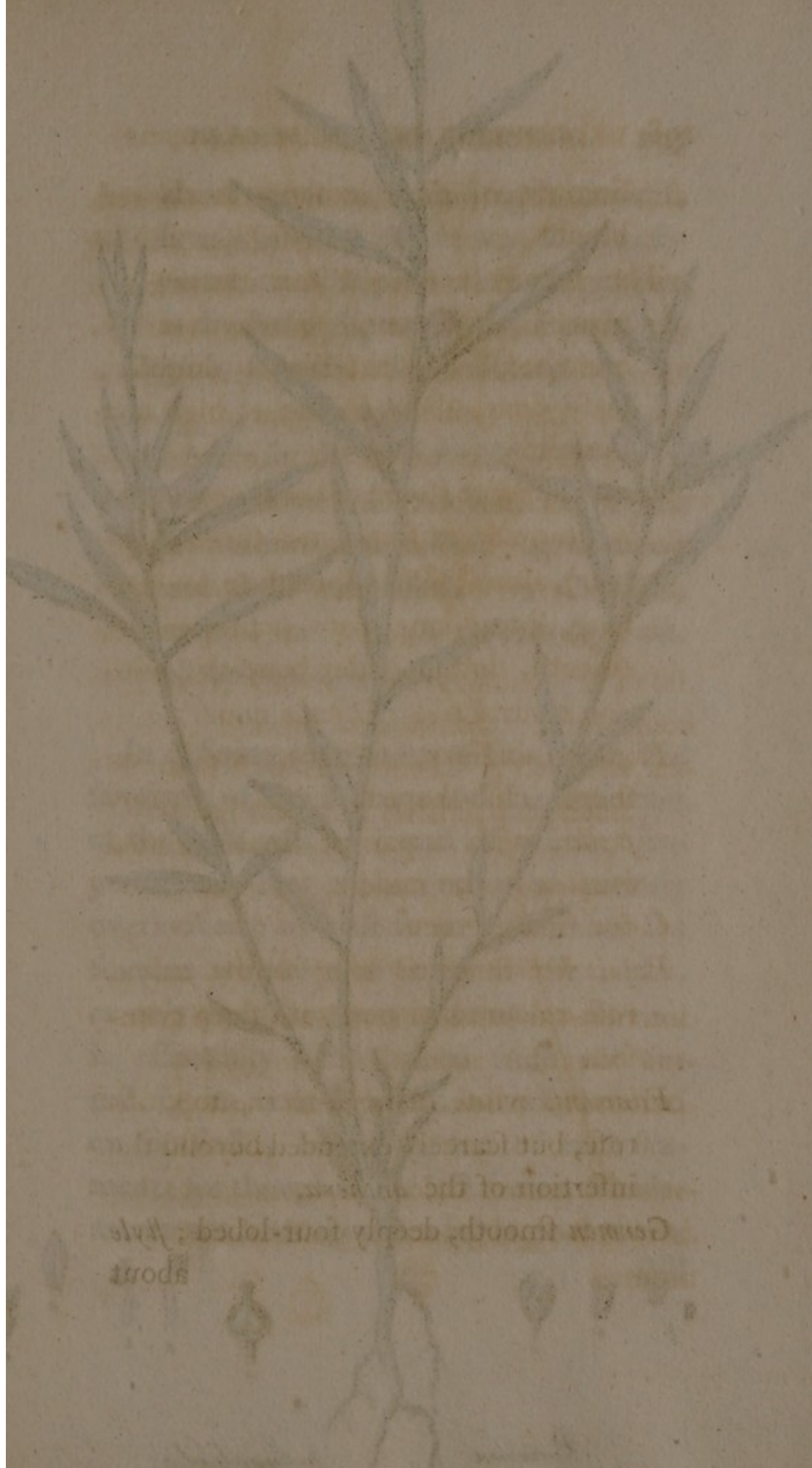
Flowers axillary, solitary, erect, on short, club-shaped, angular *flower-stalks*, with a pair of small pointed *bractæ* in the middle.

Calyx small, green.

Petals five times as long as the calyx, rose-coloured, tipped with deep crimson.

Filaments white, fringed to the top, obtuse, but scarcely extended beyond the insertion of the *anthera*.

Germen smooth, deeply four-lobed; *style* about



Grew smooth, deeply four-lobed; style
short



Boronia polygalifolia.

about equal to it in length, smooth, firmly inserted into its top, so as to separate into four parts when the germen is divided; *stigma* obtuse, four-lobed.

Capsules smooth. *Seeds* solitary.

TAB. 7. *Boronia polygalifolia*.

Fig. 1, Calyx and bractææ. 2, Petal.
3, Stamina magnified. 4, Germen and style magnified. 5, Capsules, natural size. 6, A capsule separate. 7, Arillus, and seed.

In defining the genera of this order, the structure of the stamina and the insertion of the style will be found of primary importance. Nor is number to be entirely overlooked; at least so far as whether the stamina are twice as many as the petals, or only equal to them in number. *Boronia* is essentially distinguished from all the rest, by its *antheræ* being laterally inserted on footstalks, below the top of each filament; for though in the last species the filaments are scarcely extended beyond them,

still their infertile is lateral, not terminal. There is indeed one more genus, named by me *Eriostemon*, in which those parts do stand on footstalks; but in that they terminate the filaments without any appendage. The very short style in *Boronia* terminates the summit of the combined infant capsules; in *Eriostemon* the style grows from the centre between the bases of the capsules, and is lengthened out after impregnation; this is a very important distinction. *Boronia* has always four petals, eight stamina, and opposite leaves, the last species only having them occasionally alternate. *Eriostemon* has generally five petals, ten stamina, and alternate leaves. To this last-mentioned genus I believe the *Diosma uniflora* of Linnæus belongs, having none of the proper characters of *Diosma*, except that five of its stamina, being abortive, have some resemblance to the five scales which accompany the stamina in that genus; but it wants the glandular crown of the germen, and in habit and inflorescence, as well as the structure

structure of all its parts, altogether agrees with *Eriostemon*.

The genus here for the first time described, is intended to preserve the memory of a martyr to the science, whose indefatigable zeal and singular acuteness would soon have procured him other claims to such an honour, had his premature fate been postponed.—*Francis Borone* was born at Milan, April 6th, 1769. An active enquiring mind led him at an early age from his native country; and his talents, under the influence of a person he esteemed and respected, were easily turned to natural history. His accuracy of discrimination, with regard not only to the appearance, but even the technical characters, of plants, has not often been exceeded. His ardour kept pace with his abilities. After overcoming difficulties apparently insurmountable at Sierra Leone with Mr. Afzelius, he attended the late Professor Sibthorp to Greece. The highest patronage awaited him in his own country; but he

was

was anxious to deserve rather than to obtain it, for he never by his own fault disappointed any expectations that were formed of his head or his heart. At length Providence in its wisdom disposed of him otherwise, for he died by an accidental fall at Athens, on or about the 20th of October 1794.

The following lines may serve for his epitaph :—

ILL-FATED Youth ! on whose unclouded brow
 Hope faithless gleam'd, to lure thee to thy doom ;
 And made thy various busy race below
 But a more speedy transit to the tomb !

From the chill Alps to Afric's scorching strand,
 On all thy steps fair Flora smil'd benign :
 And as her lovely offspring met thy hand,
 Their spotless bosoms emulated thine.

Each bud to thee with fairy visions teem'd,
 Of future fame and skill and knowledge fair :
 From thine own heart thy brightest prospects beam'd,
 For truth, benevolence, and joy were there.

And art thou gone ?—Are all thy virtues dead ?

Oh, no ! for Heaven's eternal justice reigns !
 Thy buds of hope, though pluck'd, shall never fade ;
 Their fruit shall ripen in celestial plains !

Nor

Nor can I withhold the following tributes to the merit of this unfortunate young man, as they do no less honour to their authors than to him :—

On the DEATH of
FRANCESCO BORONE,

By MRS. COBBOLD of IPSWICH.

WHEN great ones die, a venal train
Of Poets pour the sorrowing strain:
What elegies lugubrious flow
To swell the mimic tide of woe!
How grief resounds from shore to shore!
What Sciences their loss deplore!
The Virtues, o'er each gilded urn,
With Nature's self, are feign'd to mourn.
Thus hirelings in a neighbouring land,
Around a corse lamenting stand.
They beat their breasts, they rend their hair
With screams of anguish and despair.
'Tis feigning still :—each knows his trade;
He howls the most who best is paid.
To humble Merit will the Muse
A modest requiem then refuse—
A lay for one to Nature dear,
The faithful servant, friend sincere?
No : 'tis her pleasure to inspire
Wild melancholy's pensive lyre,
To breathe soft notes "through glade and gloom,"
And weep o'er Merit's grassy tomb.

E'en

E'en now she sings in plaintive strains,
 'Mid ruin'd Athens' mould'ring fanes :
 And thus, her ancient haunts among,
 To Worth devotes the Fun'ral Song——

FALL soft, ye gentle dews of balmy eve !

Ye sighing gales, waft night's cool fragrance here !
 While laurel with the cypress wreath I weave,
 And strew with flowers Francesco's early bier.

He loved the lonely hour, when twilight gray
 Breathes her romantic stillness o'er the soul ;
 When Fancy paints her fairy visions gay,
 And the rapt bosom owns her soft controul.

For pamper'd Pride had ne'er misled his youth.
 Rude Poverty's invigorating rule
 Taught him the lore of unaffected truth,
 And train'd his studious mind in Nature's school.

He woo'd fair Science with unceasing care ;
 With her he fought in distant climes to wend :
 Propitious Heav'n assenting heard his pray'r,
 And in the Master gave the generous Friend.

In search of knowledge, on the burning sand
 Of Afric's shores botanic wreaths he twined :
 In vain wild fever wav'd her lurid brand,
 While gratitude and friendship nerved his mind.

With heart elate, and spirits mounting light,
 To Grecia's famous coasts he bent his way :
 Hope o'er his prospects glanced her meteors bright,
 And danced before him with delusive ray.

Scarce

Scarce had he bask'd in that delusive ray,
 Scarce seen those meteor-gilded prospects bloom,
 When death, whose mandate clouds the fairest day,
 Exulting snatch'd him to the dreary tomb.

Wisdom may bid his weeping friends rejoice
 That he is happy, free from earthly fears.
 In vain shall friendship listen to the voice ;
 As vainly strive to smile away her tears :

For Mem'ry's faithful hand shall fondly trace
 His rising virtues and his soul sincere ;
 Paint Science deck'd with youth's enchanting grace ;
 Then place the portrait on Francesco's bier.

Around his grave the sweetest flow'rs shall spring,
 Bedew'd with sympathizing Pity's tear ;
 And Zephyr, from his undulating wing,
 For ever shed delightful fragrance there.

And though no trophies proud, no sculptur'd bust,
 Shall make his tomb to future ages known ;
 Immortal Athens guards his hallow'd dust,
 And consecrates his mem'ry with her own,

SONNET,

TO DR. SMITH ON THE GENUS BORONIA,

By GEORGE SHAW, M. D. F. R. S. F. L. S.

YON Flower, mild patron of the hapless Youth,
 To distant times shall guard BORONE's name :
 Thy friendship, guided by the voice of Truth,
 Hath given to humble Worth its modest claim.

So Phœbus, skill'd in all the forms that breathe
 Their balmy sweets, in richest hues arrayed,
 Grieved at lost Hyacinth's disastrous death,
 Inscribed a blossom to his gentle shade.

From the struck lyre, in melancholy strain,
 All softly trembled a celestial tone,
 That, breathing rapture o'er the list'ning plain,
 Call'd from the verdant foil a plant unknown ;
 And, sad memorial of the fatal hour!
 Raised, to record his name, a purple flower,

*Letter from the late Dr. JOHN SIBTHORP,
Professor of Botany in the University of
Oxford, to Dr. SMITH, dated Athens
Nov. 1, 1794.*

MY DEAR SIR,

I Should have been happy to have sent you a pleasant letter from Athens; but from Athens I must this time write you a very mournful one.—Poor Borone is no more! He was quite recovered from an intermittent fever, that had attacked him a little before his departure from Constantinople; and on the evening of his unhappy fate was unusually gay, singing to a tune that Arakiel, Mr. Hawkins's servant, played upon the guitar. A little after midnight we were waked out of our sleep by the cries of Francesco, who had fallen into the street, out of the window of the chamber where he slept with Arakiel. On the servants going down to him, he languishingly groaned to Arakiel, who was the first that came up to him, "Ah!

povero Francesco e morto!"—James, the other servant of Mr. Hawkins, then coming up, he said, "Ah! James, James!" and expired.

As soon as Mr. Hawkins and myself heard that Francesco was hurt by his fall, we immediately got up, and went down to him. On taking him by the hand, I found the pulse gone, and no signs of life. We directly got him into the house, and attempted to bleed him, but without effect. His loins and back, on which he appeared to have fallen, were very much bruised; but there was not the least appearance of blood, nor could I find that any bones were broken. It had rained very hard on the preceding day, so that the street was dirty: the night was dark, with frequent flashes of lightning. The opening of the window out of which he fell was extremely narrow, and appears not above eighteen feet from the ground. To get out of it, he must previously have mounted on a box that stood near it, and then squeezed himself through it. We have every

every reason to think, all this was done in his sleep. On the opposite side of the room to this window was another, that opened upon a terrace, on which he was accustomed to walk. Perhaps, if awake, which I can scarcely conceive, he had forgotten which of the two windows led to the terrace.

You may imagine that after this we passed the remainder of the night dismally enough. The next day nothing remained but to perform the last offices to poor Francesco. He was buried in the evening at the church of the Madonna, under the shade of a mulberry-tree. The obsequies were performed in a very decent manner by four Greek Priests, who chanted over him the Burial Service. Mr. Hawkins and myself, the British Consul, and some Sclavonians who were here, with the servants, attended the corpse. The Archbishop, who a few days before had expressed the strongest obligations to the English Nation, pitifully sent a Papas to demand fifty piaftres (about twelve pounds) for his
per-

permission to bury him. The Consul remonstrated with him on the impropriety and exorbitancy of the demand; when he sent a second message to say he would take half that sum. This produced another remonstrance from the Consul, when he repented, and refused to take any thing. He has since sent us a hint that he would be glad of a present. We mean to send him a Greek Testament, that a Metropolitan who has four suffragans may read a lesson of piety.

I regret with you most sincerely the cruel end of this unfortunate youth. He had escaped from the thieves of Italy, and from the inhospitable climate of Sierra Leone. He had been with me blocked up eight days by pirates at Mount Athos. Poor fellow! he was then very anxious to hide my money, that we might have something, he said, to return home with.

I shall set off in two or three days for Zante, where I shall winter. In January I propose to visit with Hawkins the Morea, and in the spring, or early in the summer,

mer, to return to England. I have made considerable additions to my collection of Greek plants and animals, having visited the Bithynian Olympus, Troy, Lemnos, Mount Athos, and Negropont. During my stay at Athens I have procured a pretty exact knowledge of the agriculture and natural history of Attica.—Tell our friends in Soho Square, that I have all the labour, if not all the sweets, of an Attic bee.

J. SIBTHORP.

WHILE I am collecting these melancholy memorials, I might, as the Poet says,

“ The verse, begun to one lost friend, prolong,
And weep another in th’ unfinish’d song.”

The writer of the above letter is now no more!—A long and uncomfortable passage of twenty-four days from Zante to Otranto, as he himself expressed it in a subsequent letter, laid the foundation of a complaint in the lungs, (more especially as he
had

had caught a severe cold in an excursion to Nicopolis near Actium,) which some months after his return to England proved fatal. His death was soon followed by that of the Hon. Mr. Wenman, one of his executors, and an excellent botanist; under whose care the publication of Dr. Sibthorp's Grecian discoveries might have made some progress, before the return of his other executor Mr. Hawkins, who is still abroad, and whose eminent talents and zeal can now alone secure to the Public any fruits from this ill-fated expedition.

FINIS.

