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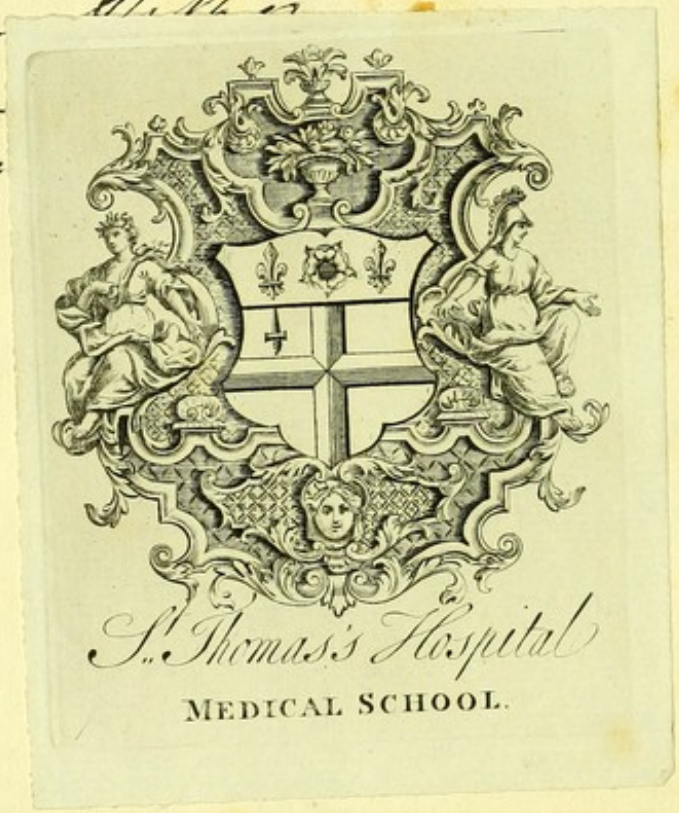

DEDICATED BY PERMISSION TO THE KING,

SOME ACCOUNT

OF

THE SCIENCE OF BOTANY,

BEING THE SUBSTANCE OF AN

INTRODUCTORY LECTURE

TO A

COURSE ON BOTANY,

DELIVERED IN THE

THEATRE OF THE ROYAL INSTITUTION OF GREAT BRITAIN.

By JOHN FROST, F.A.S. F.L.S.

OF EMANUEL COLLEGE, CAMBRIDGE,

MEMBER OF THE ROYAL INSTITUTION OF GREAT BRITAIN, OF THE ROYAL ASIATIC SOCIETY OF GREAT BRITAIN AND IRELAND, SECRETARY TO THE ROYAL HUMANE SOCIETY, DIRECTOR OF THE MEDICO-BOTANICAL SOCIETY OF LONDON, HONORARY MEMBER OF THE MEDICAL SOCIETY OF BALTIMORE, AND LECTURER ON BOTANY AT SAINT THOMAS'S HOSPITAL.

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DEDICATION.

TO HIS MOST SACRED MAJESTY

KING GEORGE THE FOURTH.

SIRE,

Encouraged by Your Majesty's Gracious condescension, in permitting me to place the following pages under Your August Protection, I beg leave, most humbly and respectfully, to lay the same at Your Majesty's feet, in the hope that the observations therein contained may be the means of drawing attention to that useful and elegant branch of Science, Botany, which only requires to be cultivated to be admired.

That Your Majesty's Reign, which has been marked by the most auspicious events, may be prosperous and happy,

and that Your Majesty may long live, to patronize whatever can tend to enlarge or enlighten the minds of your subjects,

Is the sincere prayer of

Sire,

Your Majesty's most dutiful, most devoted,

and

Most faithful subject and servant,

JOHN FROST.

Bridge-Street, Blackfriars,
May 1, 1827.

PREFACE.

THE following pages have been committed to the Press at the desire of several Members of the Royal Institution, before whom the Lecture was delivered, as well as of many of the Subscribers. When the proposal was first made to the Author, he declined it, not considering himself warranted in merely publishing the Introductory Lecture without the succeeding ones; and as there were so many excellent elementary Books on Botany extant, he conceived their publication would be superfluous. The proposal, however, was renewed, and, although the Author feels himself under some difficulty in now bringing it before the Members, after so long a silence, yet he trusts this will be removed, when he assures them that his only aim is to promote the cultivation of a Science which has lately been so much neglected, except by a few supporters of it, who are too well known to require being named here; and should the perusal of it lead one person to follow the Science of Botany, the object of the Author will be answered.

INTRODUCTORY LECTURE.

My Lords, Ladies, and Gentlemen,

I have the honour of appearing before you to commence a Course of Lectures on Botany, for your worthy Professor, Sir James Edward Smith, whose ill-health prevents his having the pleasure of meeting you this season; a circumstance very much to be regretted, and which places me in a situation of being little capable to supply his place, but, trusting to your indulgence to excuse the errors which may occur, I shall proceed to lay before you some observations by way of introduction.

In giving a Course of Lectures on any Science, it is usual for the Lecturer to deliver an Introductory Discourse, in which he endeavours to call the attention of his auditors to the antiquity of it, by tracing it to the remotest period of time that references will admit of; and it is not unfrequently contended, that the more ancient the date of the origin of his particular science is, the more likely it is to excite a degree of admiration in his auditors. But it sometimes happens, that when men are endeavouring to stamp an imaginary value on any Science, by bringing forward the names of many of the Grecian and other schools, they find so much doubt connected with their history, that one can only be surprised that they can think themselves warranted in promulgating the pretensions of some of those very early aspirers to Science. If we were to reflect a little concerning this mode of proceeding, we should find that Botany, (although derived from the Greek word βοτάνη, an herb, or grass,) had not its origin with Æsculapius, Hippocrates, Dioscorides, or, indeed, we may say with any of the ancients; for, when we consider how very much the nomenclature has been altered, and in many cases entirely changed, and how widely Botany, as we define it, differs from what the notions of it were, the absurdity of attributing to them what in this instance they really never possessed, will be very obvious. What the Greeks con-

sidered to be the Science of Botany was, in fact, that of Materia Medica, as the application of herbs to the purposes of medicine are the leading features of the works ascribed to Hippocrates and others, as we now have them collected together, from which it should be inferred that what is termed "Opera Hippocratis" for example, is not only the work of various persons, but even of different periods. Besides, we well know that they had never described the character of plants, such as the figure of their corollas, calyx, or pericarp, but only ascertained and handed down to their posterity the suitable medicinal properties of vegetables; and, however much more useful this sort of knowledge might be, yet it certainly was only a branch of medicine, and can by no means be comprehended within the term Botany, which, strictly speaking, is that Science which treats of the structure, organization, and characters of plants; and Willdenow justly observes, in his introduction to his "Principles of Botany," that "that Science which teaches us to distinguish one plant from another, and leads us to a knowledge of its peculiarities, is termed Botany;" but observe, this author does not say that Science which teaches us the virtues or properties of plants.

I trust the reason given will be sufficient, as well as satisfactory, for my deviation in regard to the history usually given of this Science by teachers of it, which has not been done from the love of novelty, but from a conviction of error in the practice alluded to.

The object of the Lecturer on this occasion is to endeavour, as far as his limited capacity will allow him, to present such an account of the Science of Botany as will be more acceptable to the august company he has the honour of addressing, by pointing out its beauties, utility, and advantages, than by tracing obscure definitions, or arraying before them a long list of difficult technical terms. It would almost appear as if the latter plan had deprived this Science of many of her votaries, who would otherwise have experienced great pleasure in cultivating an acquaintance with her charms.

Without a systematic arrangement, no branch of knowledge can be properly acquired, or retained in any degree of order by the memory, which, in all cases, is very materially assisted by such means, so that by beginning with the most simple illustrations, and gradually ascending in the scale, we shall not only steadily accomplish the object we have in view, but be able to digest the different facts which will come within our observation, and make

such comparisons as will enable us to understand the leading points of our Science, and then we can fill up the outline at our leisure. Such is the plan of the present Course; but before entering more into detail, some account of those individuals who have contributed to advance the study of Botany, as well as of those who have severally framed systems of classification of plants, together with a succinct description of their respective modes of arrangement, may not be uninteresting. I shall commence with a short memoir of Cæsalpinus, who was the first inventor of a system of plants; and as this Botanist, for he deserves the appellation, flourished towards the close of the sixteenth century, and as systematic Botany formed such an important epoch, I propose to date its origin from this great Philosopher.

We will divide the history of the Science into five æras:*—

I. From Cæsalpinus to Morrison, or from 1583 to 1669.†
II. From Morrison to Tournefort, or from 1669 to 1694.‡
III. From Tournefort to Vaillant, or from 1694 to 1717.§
IV. From Vaillant to Linnæus, or from 1717 to 1735.‖
V. From Linnæus to Smith, or from 1735 to 1791.¶

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* The Author here begs to observe, that he has omitted to print in detail that portion of his Lecture which related to those individuals who have contributed by their labours and publications to advance the Science of Botany; because he considered the publication of memoirs of them would be rendered superfluous by the excellent ones which will be found in most of the Elementary Works on Botany, as well as Biographical Dictionaries, to which he refers his readers. He, however, now inserts a list of their names, as a respectful record to which they are so justly entitled.

† I. From 1583 to 1669.—Cæsalpinus, Dalechamps, Joachim Camerarius, Tabernæmontanus, Thalius, Rauwolff, Prosper Alpini, John Bauhin, Columna, Caspar Bauhin, Spigelius, Besler, Jungermann, Parkinson, Ferrari, Cornutius, Lœsel, Ray, Ambrosini, Hoffmann, Elsholz, Bocconi, Aldrovandus.

‡ II. From 1669 to 1694.—Morrison, Barellier, Van Sterrebeck, Rudolph Camerarius, Plukenet, Amman, Dodart, Breynius, Van Rheede, Menzel, Commelyn, Hermann, Rivinus, Petiver, Plumier.

§ III. From 1694 to 1717.—Tournefort, Zwinger, Sloane, Bobart, Sherrard, Rudbeck, Anthony de Jussieu, Boerhaave, Kæmpfer, Fouillèe.

‖ IV. From 1717 to 1785.—Vaillant, Ruppius, Dillenius, Monti, Buxbaum, Bernard de Jussieu, Micheli, Geoffroy.

¶ From 1735 to 1791.—Linnæus, Haller, Miller, Burmann, Gronovius, Gleditsch, Rumphius, Gmelin, Schreber, Ch. Linnè, Forster, Gœrtner, and Banks.

Andreas Cæsalpinus was born at Arezzo, in Tuscany. He published his great work, entitled, "Cæsalpini de Plantis libri sexdecim," in the year 1683. He framed his system on the Fruit and Corculum, which displays much ingenuity. And at that period the sixteen classes into which he divided it, comprehended all such plants as were then known. This plan answered very well, as far as the knowledge of plants extended at that time; but, as the Science advanced, it was found that many plants could not be referred to any of his divisions, and that induced the next eminent person whose performance we have now to consider, Robert Morrison, to publish his System, which he framed on the formation of the flower, and the general external habits of plants. His definitions are very often exceedingly erroneous, and have been the cause of much dispute. He distributed his system into eighteen classes.

If our time permitted, we might enter into a long account of the Systems of Herman, Ray, Rivinus, and others. Tournefort's continued so much in repute, that I will just advert to it, and afterwards pass on to that of Linnæus, and de Jussieu:—

Joseph Pitton de Tournefort was born in 1656. In the early part of his life he showed great traits of genius; he would steal from school to study Nature, which, in after years, he followed up by travelling through the Continents of Europe and Asia, and was subsequently chosen Professor of Botany at Paris. This celebrated Naturalist founded his System chiefly on the form, regularity, and number of petals of the corolla; and, although he has evinced great assiduity in distributing his classes, yet all systems founded on the corolla alone must fail, because that part of a plant is subject to great variation, dependent for the most part on adventitious circumstances. For the information of my auditors, I will advert to the table which shews his arrangement, and which was followed by all the Professors of Europe of his time, and is to this day quoted by some. The limits of the Lecture will not admit of our dilating too diffusely on the comparative merits of these Systems, and we shall now examine those of Linnæus and de Jussieu.

Linnæus, who spent the early part of his life in great difficulty, and whose brilliant genius at last overcame all obstacles, first formed a System, on the figure, duration, &c. of the calyx or flower cup; after a time he found many plants that could not be referred to it, and it was not till then that he

formed the idea of the Sexual System, which now surpasses all others. I will venture to assert, without fear of proof to the contrary, that no plant has been found in any country that could be referred to one of the twenty-four classes he enumerated. Several Botanists have altered it; but, after all, the original is the best, with the alterations so judiciously made by Sir James Edward Smith, who very patriotically purchased the whole of the Herbarium of Linnæus, and he has published many new facts from it, which will ever lay Science under great obligations to him. Besides inventing *this System*, which will be the one adopted in this Course, he also described plants according to their natural affinities, and has left us fifty-five families. This brings under our immediate notice the present famous natural system of de Jussieu, which is now so generally followed, almost to the entire exclusion of the Linnæan. No person can deny the brilliancy of the talents of Jussieu, so conspicuous in all his luminous writings, and throughout his system; yet to be impartial, it must be conceded that there are many plants which cannot be referred to any of his natural orders, the number of which exceeds an hundred, and they are approached by so many points, that it requires no ordinary memory to be able to classify plants according to its rules; and had the Linnæan no other recommendation than its simplicity and easy application, that alone would be sufficient to give it pre-eminence. In adverting to these systems, my object has been rather to lay them briefly before you, than to discuss their comparative merits, trusting that the Linnæan will meet the wishes of my audience, both from the facility of illustrating it, and the ease with which the principles of it may be imparted. We shall employ the remaining Lectures in adducing examples of the different classes and orders. And now, having said so much on the arrangement of plants, we shall next consider the utility and advantages of a knowledge of Botany, which has frequently been designated as a catalogue of technical terms, without any useful application. It is scarcely worth while to endeavour to refute so futile an observation, were it not that it affords an opportunity of stating its claims to public patronage. If we consider it simply as a branch of education, what a delightful acquisition does it form with other accomplishments, and leads the mind "through Nature up to Nature's God." For who can examine the beautiful symmetry and organization of any plant, without being struck with the power and wisdom displayed throughout it? Does not an acquaintance

with such a delightful branch of knowledge, always presenting fresh living objects to the eye, bedecked in the most fascinating colours, and exhaling the most delicious odours, call forth the better feelings of the imagination; and may we not say with the poet—

"Emollit mores, nec sinit esse feros."

Let us only see how many of the arts are tributary to it, and especially remark the relation that exists between it and Agriculture. Martyn's Flora Rustica will bear out my position, as well as many other works; but to trace its immediate advantages to individuals, we would observe how indispensable a knowledge of it is to those who visit foreign climes. Not only may a ship-wrecked crew be fed by fruits which require the aid of the Botanist to discriminate as to their noxious or esculent properties, but it may even open a new channel of commerce, *e. g.* the bark of a great portion of the trees which grow in Australasia afford tannin in considerable abundance, so much so, that it has been found worth while to separate it for exportation. New fruits are by its means introduced, for it is the Botanist alone that can vouch for their character. But the principal use of Botany is in supplying us with medicines for the alleviation of disease;* and it will prove a national good, when it shall be made a part of the imperative duty of the Medical Practitioner to be acquainted with it; for there can be no doubt but that every country has plants indigenous to it for the cure of the maladies which may befal its inhabitants; for no person can suppose for a moment that the All-wise Creator has formed any thing without its use. The more the subject is investigated, the greater its advantages will appear. I would not say more, lest it should seem like over praise, but trust to your candour to excuse the insufficiency of these remarks.

Having endeavoured to shew the claims of this interesting Science on your attention, I shall now proceed to offer some observations respecting the vegetable economy. Can a mere knowledge of the external appearances of plants suffice? Certainly not,—for it is by tracing the minutiæ of Nature that we discover the mechanism of organized beings so ably contrived, and

* It will be gratifying to the Public to know, that an Institution (appropriately named the Medico-Botanical Society) has been established, for the investigation and encouragement of this important object.

so beautifully displayed, and are enabled to form just ideas of the sublime works of the Great Artificer of the Universe. Is it not contended that a man cannot be a good Physician without he is conversant with Anatomy? And may it not be argued with equal propriety, that no person can be really a Botanist, unless he is acquainted with vegetable physiology? Although some of its doctrines may, in a great measure, be thought abstruse, yet a Lecturer would be highly culpable in passing over them; indeed he would not be discharging that duty which he is expected to perform.

Whenever we investigate any subject relative to Natural Science, we find the greatest regularity and order pervading every class of bodies, whether organized or unorganized. By the former we mean such as have the actions dependent on vitality, such as circulation, respiration, and transpiration, and the power of re-production; by the latter we understand those that are composed of particles, chemically or mechanically combined, and destitute of any vital power.

A question will arise concerning the circumstances on which this vital energy depends; whether it is the result of organization or an independent principle? The best answer to such an interrogation is a candid avowal of our ignorance; but some elucidation may be gathered from the following remarks of Sir James Smith, in his Introduction to Physiological and Systematic Botany:—"The effects of this vital energy are still more stupen-
"dous in the operations constantly going on in every organized body, from
"our own elaborate frame to the humblest moss or fungus; their different
"fluids so fine and transparent, separated from each other by membranes as
"fine as those which compose the eye, all retain their proper situation, though
"each placed individually is perpetually removed and renewed for sixty, eighty,
"or an hundred years or more, while life remains; so do the infinitely small
"vessels of an almost invisible insect, the fine and pellucid tubes of a plant,
"all hold their destined fluids, conveying or changing them according to fixed
"laws, but never permitting them to run into confusion; but no sooner does
"death happen, than, without any alteration of structure, or any apparent
"change in the material configurations, all is reversed; the eye loses its form
"and brightness; its membranes let go their contents, which mix in confu-
"sion, and thenceforth yield to the laws of Chemistry alone; just so it
"happens sooner or later to the other parts of the animal as well as the vege-

" table frame; chemical changes, putrefaction and destruction immediately " follow the total privation of life, the importance of which becomes instantly " evident when it is no more. I humbly conceive, therefore, that if the " human understanding can, in any case, flatter itself with obtaining in the " natural world a glimpse of the immediate agency of the Deity, it is in the " contemplation of this vital principle, which seems independent of natural " organization, and an impulse of His own divine energy."

Now as plants are endowed with life, they are, as a natural consequence, subject to death, though the term of their existence varies greatly, *e. g.* some only live for one year, and are termed annuals; others two years, and hence named biennials; and some many years, and are called perennials. All vegetables having woody stems, (trees and shrubs), as I need scarcely tell you, come under the latter denomination.

The cedar of Lebanon is known to exist for several centuries, and it is reported that a tree named Adansonia digitata, or monkies' bread or sour-gourd tree, which is well known in the tropical and western coast of Africa, has attained the age of one thousand years, and, when they perish, even their decay furnishes manure for another series, so that nothing is lost by the change, which Dr. Darwin has thus beautifully expressed—

" Hence when a Monarch or a mushroom dies,
Awhile extinct the organic matter lies.
But as a few short hours or years revolve,
Alchemic powers the changing mass dissolve."

The dependence of this Science, as well as of most others, on the laws of Chemistry, has been finely expressed by that great chemist Sir Humphry Davy, in the following words:*—

" Even Botany and Zoology, as branches of Natural History, though independent of Chemistry as to their primary classifications, yet are related to it so far as they treat of the constitution and functions of vegetables and animals. How dependant, in fact, upon chemical processes, are the nourishment and growth of organized beings, their various alterations of form, their constant production of new substances, and finally their death and decompo-

* An Introductory Discourse delivered in the Theatre of the Royal Institution, 1802, &c. p. 8.

sition, in which Nature seems to take unto herself those elements and constituent principles, which, for a while, she had lent to a superior agent as the means and instruments of the spirit of life."

Plants are furnished with apparatus or organs for the purpose of carrying on the functions of transpiration, secretion, and absorption; and it has been proposed, as a distinguishing characteristic between animals and vegetables, that the former are nourished by their internal, and the latter by their external surfaces. How far such a criterion is to be taken is another matter, and we must be careful how we lay down axioms that are liable to dispute. The spiral tubes, of which the vegetable texture is constituted, are pourtrayed in the drawing behind me, shewing the magnified section of a leaf of the aloe; the various juices circulating therein undergo chemical changes, according to the purposes for which they are destined. The effect of light is very remarkable:—celery (apium graveolens), sea-kale (crambe maritima) are instances of it; for, were they exposed to it, the former would be so bitter, and the latter so acrid, that they could not be eaten. Common tansy, well known for its bitterness and pungency, has been eaten with impunity when excluded from the action of light. Linnæus compared the leaves of plants to the lungs of animals, as the organs by which exhalation and transpiration are carried on in vegetables; and in the animal kingdom the air is taken in by the lungs and suffers a chemical change, and does not a similar effect take place on atmospheric air? Do they not liberate a quantity of pure oxygen, and return carbonic acid gas?

Strip off all the leaves of any plant and it will die, or even if the process of transpiration be impeded by dirt, or carbonaceous matter on their surfaces, remark how soon the vegetable denotes the obstruction of its necessary office.

There are vessels which convey the juices to various parts of the plant, and others that return it; adducent and reducent vessels, corresponding, as it were, to arteries and veins in animals; deprive a plant of its sap, and you kill it; take away the blood of an animal, and you destroy it.

The various juices of plants are formed from the sap, and are not the different secretions of animals formed from the blood? Vegetables cannot exist without air any more than animals can. Place a plant under the exhausted receiver of an air pump, and it dies; put an animal under similar circumstances, and it expires.

Excess of stimulus affects vegetables in the same manner as it does animals, destroys them. Willdenow, in his Principles of Botany, when alluding to Boletus, says, "these plants require a very small quantity of oxygen to promote their growth, and, therefore, as soon as they are brought into the open air they decay. This is soon proved by the well known observation that rooms, or repositories, which are fusty or mouldy, are freed from the inconvenience by the admission of air."

We have now endeavoured to trace the analogy between the two kingdoms, so far as they can, with propriety, be compared. Linnæus suffered the brilliancy of his imagination to get the better of his judgment, when he stated that heat was the heart, and the earth the stomach of plants. In his Philosophia Botanica he says, "stones grow, vegetables grow and live, animals grow, live, and feel." The want of locomotion in plants is a very distinguishing characteristic.

The quality of the juices secreted by vegetables varies very much, *e. g.* in the Euphorbia it is extremely acrid, so much as to produce a caustic effect when applied to the skin. In others it is very bland, as the juice of the Acacia Vera, or gum arabic of the shops. The Aser Saccharina, or Sugar-Maple, furnishes to the North Americans an article well known under the name of Sugar, but which is generally obtained from the Sugar Cane or Saccharum Officinarum of Linnæus. Manna is procured from a species of Ash termed Fraxinus Ornus; and many other vegetable products might be enumerated, were it not that they would form too distended a list for present consideration.

Plants, according to the places of which they are natives, require different degrees of heat. Elasticity is common to vegetables; and it is a well known fact, that wood expands in wet weather, and contracts in dry.

Carbon, hydrogen, and oxygen, constitute the ultimate elements of vegetables, although in some plants there is a fourth element, viz. nitrogen, which exists in plants belonging to the natural orders, Cruciatæ and Fungi.*

The proximate principles of vegetables, together with their chemical history, will be comprehended in the Sixth Lecture.

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* Since I have delivered this Lecture, I have ascertained that nitrogen also exists in some plants belonging to the Natural order Atriplices.

I shall now proceed to point out, in a general way, the different parts of a plant, and the names by which they are designated. A germinating seed consists of a descending part called the endicle, and the ascending or plumula: this caudex ascendens then acquires leaves, which are connected to the stem by means of leaf-stalks or petioles. We now, as a matter of course, arrive at the flower, which is divided into the calyx or flower-cup; corolla or blossom, stamens, pistil and nectary. The stamen is divided into two parts, the filament, and the anther. The pistillum is divided into three parts, stigma, style, and germen, which, subsequently, becomes the fruit. In considering trees, we have also to consider the trunk, which consists of the

Epidermis, or outer skin;
Cortex, or bark;
Liber, or inner bark;
Alburnum, or softwood;
Lignum, or true wood;
Medulla, or pith;

the history and constituent parts of which will occupy our attention in the next Lecture.

My Lords, Ladies, and Gentlemen,

It now only remains for me to thank you for the kind and indulgent attention which you have been pleased to pay to these observations, and to assure you, that I shall have the greatest pleasure in affording you such information as the brevity of this Course precludes my detailing, and which the short time allotted for these Lectures will not admit of.

FINIS.

J. B. NICHOLS, 25, PARLIAMENT-STREET.

ERRATA.

Page 11, line 3, read, that could *not* be.
Page 15, line 22, read *retain* for return.
Page 16, line 18, read *Acer* for Aser.
Page 17, line 3, read *radicle* for endicle.