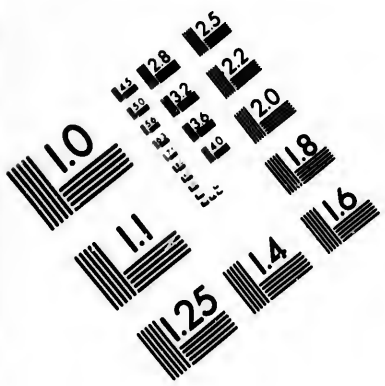

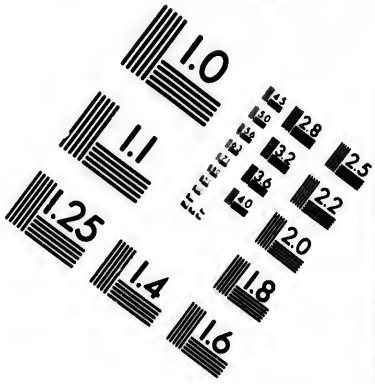

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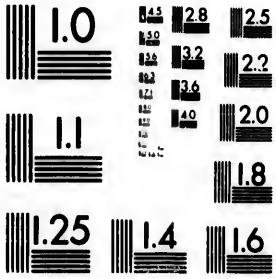

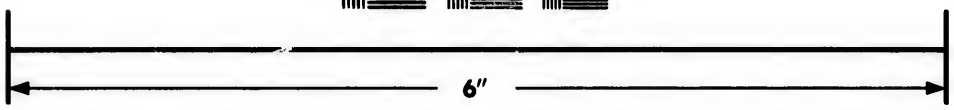

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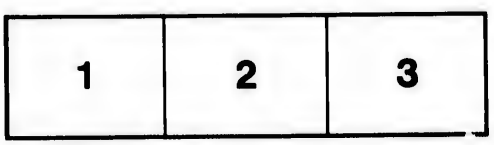

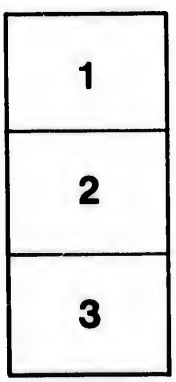

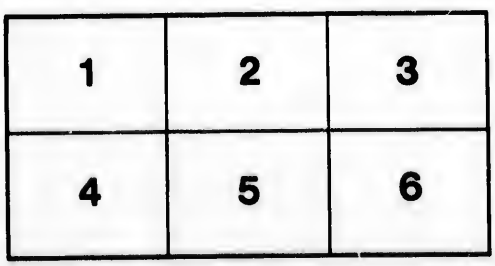

NOTES ON THE HISTORY OF BOTANY.

Read before the Hamilton Association, March 13, 1890.

BY T. J. W. BURGESS, M. B., F. R. S. C., ETC.

My contribution for your consideration this evening, entitled "Notes on the History of Botany," is indeed but a few brief notes on the subject. To prepare anything like a complete history of this charming science, is a task far beyond my ability, and, even were I able to execute it, so extensive is the subject that the listening to it would occupy, not an hour or two, but night after night of your valuable time.

In every age, in every clime, flowers have ever been regarded as among the most beautiful of the varied works of creation. Scarce a poet but has sung of their beauties—not an artist but has attempted to depict their gorgeous colorings. The sculptor and the architect have sought to render them imperishable in stone, and novelists have woven some of their tenderest fancies about them. Who has not read that sweetest of stories, "Picciola?" How the leaves of the little flowret, stretching themselves between the harsh prison stones, carried a message of truth and beauty, spoke of mercy and grace, to a despairing soul. Flowers are entwined about our lives, and from the earliest times they have been represented in the social and religious ceremonies of most countries. Children greet them with shouts of joy; to the bride they are a fitting emblem of a happy future; and at the tomb kind friends deposit them on the bodies of departed loved ones. Numberless are the lessons to be learned from these beautifiers of the earth, which smile alike upon the peasant and the peer, which bloom equally for the abode of poverty and the home of unlimited luxury. Every herb, ever shrub, every tree is full of interest; not a plant but has some peculiar beauty or some exquisite adaptation.

"Your voiceless lips, O Flowers! are living preachers,
Each cup a pulpit, every leaf a book,
Supplying to my fancy numerous teachers
From lonliest nook."

So sang the poet Horace Smith, and not less sweetly or truthfully did the Scotish minstrel, Allan Cunningham, write:

"There is a lesson in each flower,
A story in each stream and bower;
In every herb on which we tread
Are written words which, rightly read,
Will lead you from earth's fragrant sod
To hope, and holiness, and God."

Viewed even by the critical eye of science, Botany presents many attractions unknown to the other branches of Natural History, and well deserves the appellation of our French cousins, "la belle science." To the history of this most charming of studies I would now call your attention.

Botany, derived from a Greek word meaning a plant, is the natural history of the vegetable kingdom. In its widest sense it embraces everything respecting plants—their nature, their kind, the laws which govern them, and the uses to which they may be applied in medicine, chemistry, or the arts in general. As, however, their medical virtues fall most properly under the province of the physician, their chemical properties under that of the chemist, and their various other qualities, beneficent or otherwise, under different departments of the scientific world, it is commonly restricted to a knowledge of the plants themselves, their mode of growth, their anatomical and physiological phenomena, and those characteristic marks by which the various species may be distinguished from one another. It is only within comparatively recent years that, in this sense, the science of botany has been developed, its great misfortune having been that, from its very inception, it was looked upon merely as an adjunct to medicine. This was the reason why our ancestors sought only for healing virtues in plants, whilst a knowledge of the plants themselves was totally neglected. Botany, as a study, was nothing, and those among the ancients, who prided themselves most on their acquaintance with plants, had no idea of their structure or the relation borne by one class to another. They knew, perhaps, by sight a few of the plants of their own neighborhood, to which they gave names at random, and to which they attributed wonderful virtues from some fancied good resulting from their use in various ways. These same plants had different names in every state and country then known, and those who adopted them in their panaceas,

at most gave them only the name by which they were known in their own immediate vicinity. A dozen names were often given to the same plant, and the same name to a dozen plants. The confusion resulting from this arbitrary bestowal of names can be imagined. When a recipe travelled into a new locality it was no longer known what plants composed it. Everybody substituted in the mixture or ointment, as the case might be, another plant after his own fancy, but, to keep up the sale of it, gave it the same name, so that in a short time all trace of the original plant was lost. A relic of this barbarism remains even to this day in the numerous cases we have of the same common name applied to plants the most diverse, a notable instance of which exists in the term Mayflower, affixed to at least half a dozen different plants in as many different orders. For example, the Trailing Arbutus *(Epigæa repens)*, the Spring-Beauty *(Claytonia Virginica)*, and the June-Berry *(Amelanchier Canadensis)*, are all known by this title in different localities, a fact which has led to no little disputation in the effort to establish what plant was originally so called by the New England Loyalists. Probably, at this period, some good observations, which deserved not to have been forgotten, were made, but, amid such a chaos of nomenclature, those who made them had no possible means of communicating or recording them in a recognizable style. The result was that there followed endless disputes upon words and names, every useful enquiry and description being lost for want of the disputants being able to decide what plant each observer had really referred to.

Not content with such a mixing of names and terms, these earliest botanists, or more properly herbalists, drew largely on their imagination for properties in plants, or greatly exaggerated any slight virtue they actually possessed. Their object in this was, most likely, the filling of their pockets at the expense of their dupes, for quacks existed in those days as well as in our own. However, be their reason what it might, the fact remains that, through such deceptions, many marvellous beliefs about plants arose and were handed down. Most of these, viewed in the light of modern philosophy, are truly laughable. Thus, Xanthius, the historian, tells us that a man killed by a dragon can be restored to life by a herb, which he calls *balin*, and Democritus gravely asserts that there is a plant, the juice of which applied to a wedge will cause it to

spring out of the tree into which it has been driven. Again, Vitruvius, speaking of the virtues of Spleenwort *(Ceterach Officinarum)* as regards its reputed action on the spleen, says that in the island of Crete, on the side toward Cortyna, the flocks and herds were found without spleens because they browsed on this herb, while on the other side, toward Gnosus, they had spleens because it did not grow there. Such superstitions continued through the days of the Roman Empire, were very prevalent during the middle ages, and remnants of them still exist, especially in country districts. How fixed was the belief in the magical properties of certain plants, may be judged from the following lines by Virgil, written, not in a strain of poetic, fervid imagination, but of sober earnest:

> "These poisonous plants, for magic use designed,
> (The noblest and the best of all the baneful kind)
> Old Mæris brought me from the Pontic strand,
> And culled the mischief of a bounteous land.
> Smeared with their powerful juices, on the plain
> He howls, a wolf among the hungry train:
> And oft the mighty necromancer boasts
> With them, to call from tombs the stalking ghosts."

Later, we find Culpeper, in his herbal published in 1653, saying of Moonwort *(Botrychium Lunaria)*: "Moonwort is an herb which will open locks, and unshoe such horses as tread upon it, and country people that I know call it 'Unshoe the Horse.' Besides I have heard commanders say, that on White Down in Devonshire, near Tiverton, there was found thirty horse-shoes pulled off from the feet of the Earl of Essex his horses being there drawn up in a body, many of them being but newly shod, and no reason known." Numberless further examples of the superstitious belief in the magic power of plants might be cited, but I must pass on to the history of botany proper. This, for convenience of description, I shall divide into four great epochs, calling them the Ancient, the Arabian, the Artificial, and the Natural Epochs.

The Ancient Epoch embraces the period between the creation of the world and the destruction of the Western Empire by the Goths and Vandals, which races, cradled in war and rapine, hated science, believing it caused effeminacy in its devotees, and would not allow their children to cultivate it. The earliest known mention of plants is in the Book of Genesis, where it is recorded by Moses that, on the

third day God said: "Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth; and it was so." It is also recorded that Adam gave names to all the beasts of the fields and fowls of the air, and the "Blind Bard" Milton, in his "Paradise Lost," has beautifully and poetically ascribed a similar task to Eve regarding the flowers, making her exclaim, in her lamentation on quitting the Garden of Eden:

"Oh flowers,

* * * * * * * * * * *

* * * which I bred up with tender hand

From the first opening bud, and gave ye names."

Throughout the Bible we find numerous allusions to trees and herbs, and Solomon, it is probable, wrote a treatise upon the subject, for in the Book of Kings it is said of him: "He spake proverbs and songs; he also spake of trees, from the cedar-tree that is in Lebanon, even unto the hyssop, that springeth out of the wall." Anything he may have done in this way, however, is totally lost. Anaxagoras, Pythagoras, and other ancient Grecian philosophers also wrote upon plants, but their works have shared the same fate, and the poems of Homer, in secular literature, afford us the only vestiges of the botanical knowledge of the earliest ages.

Aristotle included the vegetable kingdom among his numerous subjects of study, and considered plants as intermediate between unorganized matter and animals. Although we know that a treatise on botany was issued among his other writings on Natural History, about 384 B. C., all trace of it having disappeared, we may say that the proper historical era of the science begins with his friend and disciple Theophrastus, who, about 300 B. C., published a History of Plants in ten books, only one of which, however, is now extant. In this he treats of the origin, propogation, and anatomy of plants, describing about five hundred species, which are divided into classes with respect to their generation; their place of growth; their size, as trees or shrubs; their use as culinary herbs and esculent grains; and their juices.

Nearly three hundred years after the time of Theophrastus, or about the beginning of the Christian era, another Greek, Dioscorides, travelled over Asia Minor and Italy, studying plants, of which he gives the names and properties of about six hundred, arranged in four classes, according to their uses; viz., aromatic, nutritious,

vinous, and medicinal plants. Nearly contemporary with Dioscorides were Cato, Varro, and Virgil, who wrote on agriculture and rural economy.

Following these worthies came the elder Pliny, who, in his fifty-sixth year, became the victim of his curiosity for enquiry, while attempting to witness an eruption of Vesuvius. He devoted sixteen of the thirty-seven books comprising his "History of the World" to plants. Besides enumerating the discoveries of Theophrastus and Dioscorides he described many new species, bringing the number up to above a thousand. Like the other ancient botanists though, Pliny admits, with little or no distinction, truth and error, useful knowledge and absurd fable, which fact, together with the want of a proper systematic arrangement, renders it impossible to determine which are the plants he described.

With Pliny closes what I have called the Ancient Epoch of Botany, for after his time, its study rapidly declined, and ages of darkness and lethargy succeeded.

The second, or Arabian, Epoch of Botany began during the eighth century, with the reappearance of the elements of ancient plant lore among the Saracens. This barbarous but noble race, who had formerly shown their contempt for science by the wanton destruction of the magnificent library of Alexandria, at this time became imbued with a love of it, chiefly by contact with the many enlightened men, who, banished by the Emperor Theodosius, had found refuge amongst them. A succession of Caliphs, most notable of whom was the famous Haroun Alraschid, by their fostering care of learning and learned men, made Bagdad the most enlightened city in the world. Serapion, well known in medicine, stands first on the Arabian catalogue of botanists, and was followed by Rhazis, Avicenna, Averhoes and Actuarius, while Plato Apuleius, of whose herbarium very old manuscript copies are still preserved, is supposed to have lived about this period. These men discovered many plants of Persia, India and China, which were unknown to their predecessors, but unluckily they thought less of observing nature and chronicling their own observations, than of translating and commenting on the old Grecian writers. In consequence, their descriptions of plants are imperfect, and, for want of a systematic arrangement and comprehensive nomenclature, generally unrecognizable. If, however,

they did little to advance the science, they at least kept alive the love of it, and vigilantly watched over the intellectual treasures of antiquity, translating the works of the ancients and introducing them into their schools.

Early in the eighth century, the Moors, who had made themselves masters of northern Africa, induced by the representations of the traitorous and apostate Count Julian, crossed the straits under the command of Taric ben Zeyad, or, as he was known to the Spaniards, Taric el Tuerto, or Taric, the one-eyed. Seizing the rock of Calpe, this doughty chieftain fortified it as a stronghold, changing its name to Gibel Taric, or the Mountain of Tarib, since corrupted into Gibraltar; and by his defeat of Don Roderick, last of the Goths, on the banks of the Guadalete, ended the Gothic power, which had remained unshaken in Spain for two and a half centuries. The subjugation of the whole peninsula was speedily completed, and the elements of botanical science, as known to the Arabs, soon spread to France, Italy, Germany, and England. Abenguist, a famous Saracenic physician and botanist, flourished about the end of the twelfth century, and superiority in the sciences was preserved by the Arabians until toward the close of the fifteenth. But when, in 1492, this wonderful people, gradually divested of their European conquests, lost their last foothold in Spain by the fall of Granada, they seemed at once, with the departure to Africa of the the last of the Moorish kings, Boabdil el Chico, to replunge into that savage ignorance from which they had so brilliantly emerged.

Arrived now at the beginning of the sixteenth century, we enter upon the third great botanical epoch, which I have called the Artificial, being the period during which the artificial arrangement of plants flourished, a period adorned by such names as Cæsalpinus, Morison, Ray, Tournefort, and, greatest of all, the immortal Linnæus.

An artificial classification differs from a natural one, in that the former singles out one or more points of resemblance or difference, and arranges by them without reference to other considerations, convenience and facility being the controlling principles. On the other hand a natural system aims to arrange all known plants into groups according to their resemblances and their degrees of resemblance, so that each species, genus and order shall stand next to that which it most resembles *in all respects*, or rather in the whole plan of structure.

In other words, an artificial system arranges plants on a certain part, or parts, of them, while a natural one takes all the parts into consideration.

The initial point of this epoch was the arising of greater independence of thought concerning ancient writers. Men began to say—we have been looking everywhere for the plants of Theophrastus, Dioscorides, and Pliny, whereas they did not know a tithe of those covering the earth. What foolishness to endeavor to apply to the plants of one's own country, France, England, etc, as the case might be, the names under which these men described those of Greece and Asia, without knowing whether they are the same. We must explore each country, and collect, examine and compare the plants of the one with the other, for then only will we be in a position to distinguish them.

About 1536 the first botanical garden of modern times was establish in Italy, on the banks of the river Po, by Brasavola, but to the Germans belongs the honor of being the first to publish books founded mainly on *actual observation*—Otto Brunfels, of Mayence, having issued such a work in 1530. It also contained the first cuts, but, as Willdenow remarks: "The drawings are not very good, and do not in the least correspond with his own descriptions." To Germany is also due the credit, in the Herbal of Jerome Bock, published 1532, of producing the first botanist, who replaced the old alphebetical order, in which plants had always been hitherto described, with an arrangement depending on their natural resemblances, that is the likeness which may be observed by the most unscientific persons in their general forms and characters. Crude as was his work it introduced a new principle which had the greatest influence in promoting the advancement of systematic botany. Up to this time botanists had blindly followed the ancient writers in classifying plants by their roots, herbage, time of flowering, place of growth, medical or economic uses, and other arbitrary distinctions, and it was not till about 1560 that Conrad Gesner, of Zurich, in his "Historia Plantarum," first suggested the existence, in the vegetable kingdom, of groups, or genera, each composed of many species united by similar characters of the flower and fruit. Gesner did not, however, establish any plan founded upon this principle, but, having formulated the idea, left its first application to Dr. Andrew Cæsalpinus, a physician of Pisa, Italy, who, in a work published in Florence, in

1583, proposed to form species into classes, and thus originated systematic botany. The characters which he employed for this purpose were the duration and size of plants, the presence or absence of flowers, the number of cotyledons, the situation of the seed, the adherence of the pericarp to the seed, the number of cells in the paricarp with the number of seeds in each of these cells, the adherence of the calyx to the germ, and the nature of the root, whether bulbous or filrous. This method was too imperfect to be adopted, however, and for nearly a century no one appeared to follow in the path which Cæsalpinus had opened. During this interval though, the science was gradually improved in its details, Clusius teaching botanists to describe accurately by discarding superfluous terms without the omission of any important characteristic, and the brothers, John and Caspar, Bauhin adding to their respective works a synonymy, or exact list of the different names which all previous writers had applied to the same plant. In the same period, too, flourished a number of other and less illustrious authors, some of them chiefly notable for the useless or laughable systems they proposed, to wit.: Du Pas, a Frenchman, suggested an arrangement of plants by their time of flowering, and Porta, an Italian, one from their relation to the stars, to men, and to other animals.

In 1680, Robert Morison, a native of Aberdeen, Scotland, and Superintendent of the Botanic Gardens at Oxford, revived and carried into practice the principle of Cæsalpinus, in his great systematic work, "The Universal History of Plants." Morison sets out with the division of plants, from their consistence, into ligneous and herbaceous, and founds his system on their fruit, blossoms, and habits. Two years later, John Ray, of Trinity College, Cambridge, proposed another system of classification in his "Methodus Plantarum Nova," a work amended and completed in 1703. He divided plants into thirty-five classes, formed on their habits and external appearances, their greater or less degrees of perfection, their place of growth, the number of seeds, petals or sepals to the flower, and the kind of fruit or inflorescence. The great merit of Ray's system was his division of herbs into flowerless and flowering, and the latter into dicotyledenous and monocotyledonous; its great fault the primary division of plants into trees and herbs. This division of plants into trees and herbs, referring the larger shrubs to the former the under-

shrubs to the latter, had been adopted by every botanical writer since the days of Aristotle, and by its antiquity had gained an importance to which it was by no means entitled. The first to note the great demerit of such a primary division, from its uncertainty and repugnance to the spirit of system, was Augustus Rivinus, Professor of Botany at Leipsic, who, eight years after the first publication of Ray's system, that is in 1690, discarded it and proposed a classification based wholly on the corolla.

Knaut, Herman, Bœrhave, Ruppius, and Ludwig were also prominent botanists of this, the seventeenth, century, but the next after Rivinus to advance a leading system was Joseph Pitton de Tournefort, a native of Provence, and Curator of the Jardin du Roi. Tournefort travelled through Spain, Holland and the East, collecting extensively, and published his method of classification, "Elements of Botany," in 1694. It was more definite but more artificial than that of Ray, being based, like Rivinus', almost wholly upon modifications of the corolla, but unfortunately it revived the old division of plants into trees and herbs, which the latter had so wisely discarded. Its great advance over previous systems was, that in it, genera, as we now understand them, were first established and defined, all the species then known being referred to them, so that, in one sense, Linnæus was right in calling Tournefort the founder of genera.

Many authors of note followed the lead of Tournefort, including Jussieu, Vaillant, Petit, Vallentin, Dillenius, Linden and Sloane, but it was not until 1735 that Linnæus, suddenly emerging from obscurity, offered to the world a system of botany so far superior to all others as to leave no room for dispute as to its comparative merit. Karl Linné, or, as he is more commonly styled, Linnæus, was born on the 23rd of May, 1707, at Rashult, in Sweden. His father, a clergyman, had designed his son for the same sacred calling, but the boy's teachers seeing him pay less attention to Hebrew and theology than to the study of natural history, advised him to apprentice him to shoemaking or some other trade, as being quite unfit for any of the learned professions. Happily for the progress of science this advice was not acted upon by the disappointed parent, who, instead, accepted the offer of one Dr. Rothman, Professor of Medicine in the College of Wexio, to give him an education preparatory for his entering his own profession. For some time after

his matriculation at the University of Lund, in 1727, young Linnæus' struggle was a terribly uphill one. His endeavor to pursue both his botanical and medical studies, while relying for support on the instruction of private pupils, made his circumstances almost desperate. His father was too poor to do anything more for him, and he was often indebted to his fellow-students for an occasional meal or cast-off garment. In 1729, however, just when his fortunes were at their lowest ebb, he was engaged by the Rev. Olaus Celsius, one of the Professors at Upsal, to help in a work he was preparing, illustrative of Bible plants.

A small work of Vaillant's, on the structure of flowers, now fell into his hands, and from the ingenious remarks of that writer on the existence of sex in plants, he conceived the idea of a system of botany founded on the stamens and pistils, a system on which were arranged nearly all his subsequent botanical contributions. About the same time a short treatise which he had composed, attracted the attention of Rudbeck, Professor of Botany, who, being old, was desirous of obtaining a competent assistant, and he assigned to him the office of demonstrating plants in the botanic garden, giving him also free access to his fine library. The clouds of poverty and obscurity were thenceforth gradually dispelled, and Linnæus became known to men of talent as a rising genius. In 1731 he was sent by the Royal Academy of Sciences at Upsal to investigate the natural history of Lapland, the results of which expedition he afterwards published in his "Flora Lapponica." In 1734 we find him acting as travelling tutor to the sons of Baron Renterholm, and in 1735 setting out to take his degree as doctor of medicine in Holland, where it could be procured at much less expense than in Sweden. While in Leyden he called upon the celebrated Dr. Gronovius, who, returning the visit, saw the manuscript of his "Systema Naturae," and was so astonished and delighted with it that he requested Linnæus' permission to get it printed at his own expense. The Dutch botanists received the work with the utmost cordiality, and immediately embraced and adopted the system, which was further amplified by the publication of the "Genera Plantarum." Linnæus next, in succession, visited England, where he made the acquaintance and secured the friendship of Sir Hans Sloane and the learned Dillenius, and France, where the Jussieus, uncle and nephew, showed him every courtesy. Returning to Sweden he settled in Stockholm

to begin the practice of his profession, and in 1739 married a Miss Moræus, to whom he had been long engaged, but whom he had previously been prevented marrying by his straitened circumstances. Soon after he was appointed to fill the chair of natural history in the Upsal University, and his great fame and extensive correspondence enabled him to enrich the academic gardens with an immense variety of plants. Jussieu and Van Royen sent him those of India, Haller and Ludwig European ones, and Collinson and Catesby specimens from the New World, while his pupils Thunberg, Hasselquest, Kalm, Osbeck and others gave him details and material from their travels in Europe, Asia, Africa and America. Riches now flowed rapidly in upon him, and in 1757 he was elevated to the nobility, taking the title of Von Linné. This speedy rise to wealth and honors did not, however, in anywise diminish his assiduity in study, and an extraordinary number of works were completed in various departments of natural history, all evincing the same clearness of ideas and precision of language which have made his writings so especially valuable. Toward the close of his life, Linnæus, who for many years had enjoyed excellent health, was attacked by apoplexy, which, in some degree, impaired his mental powers. The first attack occurred in 1776. In the succeeding year he had a second stroke, and, after a lingering illness, died on the 10th of January, 1778, in the seventy-first year of his age. A general mourning of the nation followed, while the king, Gustavus III, in a speech from the throne, alluded to his death as a public calamity, and ordered a medal to be struck expressive of the national grief at his loss. The best idea of the marvellous ability of this great man is gained from the title by which he has been honored by the scientific world, a far prouder one than any mere hereditary distinction, that of "Prince of Naturalists."

Linnæus' greatest work, the "Species Plantarum," which Haller has emphatically termed "Maximum opus et aeternum," appeared in 1753. To this all his other botanical productions were in some measure only preparatory.

The Linnæan or Sexual System is, briefly, as follows. All known plants are divided into twenty-four classes, the characters of which are formed on the number, or difference in situation or arrangement, of the stamens. The names assigned to these classes are of Greek derivation, and express their several distinctions, *e. g.*, Mon-

andria, Diandria, Triandria, etc Stamens and pistils exist in all the classes except the twenty-fourth, which embraces the Cryptogamia. The orders are founded, as far as possible, on a similar number, situation or arrangement, of the pistils. The strongest recommendation and the sole aim of the Linnæan artificial system was to help anyone to learn the name and history of an unknown plant, in the most easy and certain manner, and even after the recognition of the natural system, it was customary to prefix it to Floras as a key to the genera. It stands unrivalled as a convenient artificial classification of plants, and the impetus its introduction gave to the study of botany throughout the civilized world is without a parallel. Although its classes and orders have passed away, the Linnæan genera and species have stood the test of time most wonderfully, a fact owing to the remarkable exactness of the great author's descriptions, as well as his keen preception of the true relationships of plants.

Not least among the wonderful works of Linnæus was his introduction of a binomial nomenclature, or the method of distinguishing every plant by only two words. Prior to his time a whole sentence was often required to express the name of a plant, and to such a length had many of the names grown that had it continued the study of botany must have been abandoned from its mere unwieldiness. The terrible labor of handling these long names may be judged from the following extract from a letter of Dillenius to Linnæus.

"In your last letter I find a plant gathered in Charles Island, on the coast of Gothland, which you judge to be Polygonum erectum angustifolium, floribus candidis of Mentzelius, and Caryophyllum saxatilis, foliis gramineis, umbellatis corymbis of Bauhin; nor do I object. But it is by no means Tournefort's Lychnis alpina linifolia, multiflora, perampla radice, whose flowers are more scattered and leaves broader in the middle, though narrower at the end."

The poor plant, the object of all these opprobrious epithets, seems to have been *Gypsophila fastigiata*, L., a Swiss plant of the order Caryophyllaceæ.

Linnæus himself did not at first perceive the great value of a binomial nomenclature, and in his early works he distinguished species by the long explanatory phrases of the older botanists; thus, in his "Flora Lapponica," he names a violet, "Viola foliis subro-

tundis cordatis pedunculis radicatis," which translated would make the name of the plant, the violet with long-peduncled, subrotund, cordate root-leaves. This unwieldy title for the common European marsh-violet, he afterwards, in his "Species Plantarum," where he first used, as he terms them, *trivial* names, converted into *Viola palustris*, the name it still bears.

With Linnæus I will close what I have named the Artificial, and enter on the Natural epoch of botany, for though his system of classes and orders held sway for nearly a hundred years, and some of you probably studied it in one or more of the numerous authors who copied him, yet, even before his death, there had begun to spring up the natural system which is now in use That Linnæus himself recognized the importance and superiority of such a system we know by the following extract from one of his letters on the subject to the celebrated Professor Haller of Gottingen.

"I have never spoken of my sexual system as a natural method; on the contrary, in my Systema I have said, 'No natural botanical system has yet been constructed, though one or two may be more so than others; nor do I contend that this system is by any means natural. I do not deny that a natural method is preferable, not only to my system, but to all that have been invented. Probably I may, on a future occasion, propose some fragments of such a one. Meanwhile, till that is discovered, artificial systems are indispensable.'"

This expressed intention to attempt a natural classification was carried into effect by an effort to group the known genera under sixty-seven natural orders, Piperitæ, Palmæ, Amentaceæ, etc., but was afterwards abandoned.

The problem was taken up by a contemporary and correspondent of Linnæus, Bernard de Jussieu, a Frenchman and curator of the Royal Garden at Trianon, who, however, left nothing in writing but a bare catalogue of the gardens, and it was left for a pupil of his, one Michael Adanson, a native of Provence, to first publish, in his "Familes des Plantes," 1763, a complete system of natural orders. Under this system one class consisted of all plants with similar roots, another of all with similar stems, and a third of all with similar leaves as regarded form and situation, but the most important distinctions he considered as founded on the organs of fructification. The system of this ingenious botanist, whose name is pre-

served in the Adansonia or Calabash tree of Africa, was so cumberous and had such a barbarous nomenclature that it never found many supporters, and the fame of being called the founder of the natural system of botany has fallen to Antoine Laurent de Jussieu, to whom more than any other person the honor may be ascribed. This Jussieu, who was born at Lyons, France, in 1748, was the nephew of the Bernard de Jussieu mentioned before, whose pupil and assistant he became when still a youth. Like most of the distinguished early, and indeed later, botanists, this great genius had adopted the profession of medicine, to which even yet botany was only considered an accessory science, and the first few years of his life in Paris were devoted to the study of it. Afterwards appointed demonstrator of botany at the Jardin du Roi, now the Jardin des Plantes, he thenceforth gave his entire time and energy to his favorite science, and especially to the conditions necessary to the formation of a natural system. After nineteen years patient labor he published, in 1789, his "Genera Plantarum Secundem Ordines Naturales Disposita," in which one hundred natural orders of plants were first established and defined by proper characters, nearly all known genera being arranged under them. His primary division of the vegetable kingdom was into Acotyledones, Monocotyledones, and Dicotyledones, which were again subdivided into fifteen classes. The reception accorded to the system of Jussieu was not nearly as cordial as to that of Linnæus, the two systems being regarded as rivals, and many works were published endeavoring to show that the method of the former was not more natural than the Linnæan, while inferior as an artificial one.

The next great systematist was Augustine Pyramme de Candolle, another member of the medical profession, who was born at Geneva, in 1778, a year made memorable by the death of Linnæus, an event which occurred only about three weeks before the birth of one who stands only second to him in the same department of science. In his "Principes de Botanique" prefixed to the "Flore Francaise," published in 1805, he reversed the order of Jussieu, which proceeded from the lower to the higher forms of vegetable life, and began with the latter. On account of its convenience this order has been commonly followed ever since. In the Candollean system the primary division is into Vascular (more properly Phænogamous) plants, and Cellular (more properly Cryptogamous) plants.

These in turn are again divided, the former into Dicotyledenous or Exogenous and Monocotyledenous or Endogenous plants; the latter into Ætheogamous plants, those with sexual apparatus and vascular or cellular tissue, including Equisetaceæ, Filices, Musci and Hepaticæ, and Amphigamous plants, those destitute of sexual organs and composed of other than cellular tissue, including Lichens, Fungi, and Algæ. The great fault in this system was the non-recognition that plants of all orders are bisexual.

John Lindley, Robert Brown, and Stephen Endlicher, between 1827 and 1843, variously modified, and in some respects improved, the Candollean arrangement, and the "Genera Plantarum" of George Bentham and Joseph D. Hooker, the third and concluding volume of which was issued seven years ago, brings our history of botany down to the present day. These latter authors adopt in a general way the Candollean sequence of orders, with various emendations, and theirs is the system now generally followed. Begun in 1862 and finished in 1883, these volumes stand as the second great botanical work of the present century, the "Prodromus" of De Candolle being the first.

In the September, 1883, number of the "American Journal of Science," Dr. Gray compared the various published "Genera Plantarum" in the following way, which may be of interest to you: "Some idea of the progressive enlargement of the field may be had by a comparison of the number of genera characterized in these successive works. The phænogamous genera of

Linnæus, "Genera Plantarum,"	published	1737,	were	887
Jussieu,	"	"	"	1789,	" 1707
Eudltcher,	"	"	"	1843,	" 6400
Bentham & Hooker,	"	"	"	1883,	" 7585

An estimate of the known number of species of each genus and higher group has been made throughout the work. In round numbers it may fairly be said that about one hundred thousand species of phenogamous plants are in the hands of botanists."

It will thus be seen that in a little less than one hundred and fifty years the number of genera has been increased from 887 to 7585.

I cannot close this brief, though I fear for your patience too lengthy, account of the history of botany, without calling to your attention the names of some of the most distinguished writers on

American plants, whose efforts have in more ways than one helped to bring the noble science of botany to its present advanced state. Among them are Bartram, Michaux, Muhlenberg, Pursh, Eaton, Nuttall, Torrey, Bigelow, and, last but greatest, the late, lamented Dr. Asa Gray, at whose death, so recently as January, 1888, our society expressed by unanimous resolution its deep regret.