AN ADDRESS

TO THE

CITIZENS OF HARTFORD,

ON THE

BIRTH-DAY OF LINNÆUS:

MAY 24th, 1836.

IN BEHALF OF THE OBJECTS

OF THE

Natural History Society;

FORMED

OCTOBER 8, 1835.

BY SAMUEL FARMAR JARVIS, D. D.

PRESIDENT OF THE SOCIETY.

FELLOW OF THE AMERICAN PHILOSOPHICAL SOCIETY OF PHILADELPHIA, THE AMERICAN ACADEMY OF ARTS AND SCIENCES, OF BOSTON; THE AMERICAN ANTIQUARIAN SOCIETY, OF WORCESTER; THE NEW-YORK HISTORICAL SOCIETY, THE LITERARY AND PHILOSOPHICAL SOCIETY OF NEW-YORK, ETC. ETC.

HARTFORD.

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1836.

Extracts from the Records of the Natural History Society, June 3d, 1836.

"Voted, that the thanks of the Society be presented to the Rev. Dr. Jarvis for the Address, delivered before the Society on the 24th day of May, 1836, and that a copy of the same be requested for publication."

"Voted, that the Rev. Dr. Jarvis be requested to comply with the invitation from the Wesleyan University at Middletown, to deliver his address before the Natural History Society of said Institution." Attest,

ERASTUS SMITH, *Rec. Sec'y.*

WESLEYAN UNIVERSITY,
MIDDLETOWN, July 11, 1836.

Rev. S. F. JARVIS, D. D.,

SIR:—I am directed by the Natural History Society of the Wesleyan University, to express to you the very great satisfaction they experienced in listening to your very able and interesting Address on the rise and progress of Natural Science, delivered before them, as well as many citizens of this place, on Wednesday evening last. As it is understood the Address is to be published by the Society before whom it was first delivered, it is requested that, in the edition printed, provision may be made to supply the members of our Association.

Very Respectfully,

JOHN JOHNSTON, *Cor. Sec'y.*

ADDRESS.

GENTLEMEN OF THE SOCIETY, AND FELLOW CITIZENS:

I RISE to address you on the objects for which the Natural History Society of Hartford has been founded, with no small degree of diffidence. The pursuits of my life have left me but little leisure to cultivate the study of Nature; and at the time when they might have taken that direction, the opportunities for acquiring such knowledge were in this country imperfect and confined. I am conscious therefore that I see before me many who are infinitely better qualified than myself for the present employment. Yet as the Society have seen fit to honour me with the office of being their first President, the duty seems properly to devolve upon me of making the public acquainted with the motives which led to our union. I claim your indulgence therefore while I proceed to lay before you some observations tending to shew

THE NATURE OF OUR OBJECTS,
THE IMPORTANCE OF THEM, and
HOW THEY ARE TO BE ACCOMPLISHED.

For this purpose I cannot think of a better method than, first to give you an outline of what has hitherto been done in Europe and in our own country, in the several depart-

ments of Natural History. The narrative must of necessity be cursory; for it will embrace what might easily be swelled into volumes. But it will exhibit, if I am not mistaken, the importance of our objects, and you will thereby be better prepared to determine, how we are to accomplish them.

I.

It so happens, fellow citizens, that the period of time which is now to pass in review is precisely that of the existence of our city; and it may be divided into two centuries corresponding with that existence;

The first, from the laying out of the Royal garden of plants, in Paris in 1635;

The second, from the publication of the Linnæan System in 1735.

The formation of our society preceded one month the second Centennial celebration of the settlement of Hartford.

The Italians have the honour of being the first who established Botanic gardens; and they were followed in the order of time, first by Holland, and afterwards by England. Yet the establishment of the Garden of Plants at Paris, the very same year in which the first settlers of Hartford were felling the forests and clearing the land for culture, deserves to be singled out from the rest as forming an epoch in Natural History. It should be thus distinguished, because it has not been confined to Botanical science, but has been made the depository of every other branch of natural knowledge; has contributed more than all the rest to the formation of scientific naturalists; and may now boast of the largest and most complete collection in the world.*

* See Note A.

The same year was remarkable as being the first of the literary career of Robert Boyle, the father of Chemistry and experimental Philosophy. In the language of the Biographia Britannica, he was "a man superior to title and almost to praise; illustrious by birth, by learning, and by virtue; but most so as the author and encourager of the new philosophy; by which he has not only rendered his memory immortal, but has also derived honour to his country, which perhaps is the greatest felicity that human abilities can ever attain." Nor was this praise confined to his own countrymen. "Boyle," says the great Boerhaave, "the ornament of his age and country, has inherited the genius and talents of the great Chancellor of Verulam. Which of his writings ought I to praise? All of them. We owe to him the secrets of fire, air, earth, animals, vegetables, fossils; so that from his works may be deduced the entire system of natural science."*

In 1638, his father, the Earl of Orrery, sent him upon his travels under the care of a governor with whom, at the same time, he continually pursued his studies; and after thus passing six years in France, Switzerland and Italy, he returned to England in 1644. The next year, though he was then but nineteen, he took an active part in that voluntary association of distinguished men which formed the nucleus of the present Royal Society of England.

We have the fact on the authority of the famous Dr. Wallis; and as his narrative is curious and gives an idea of the nature of their meetings and the state of the natural sciences at that time, I relate it in his own words. "About the year 1645, while I lived in London, at a time when by our civil wars, academical studies were much interrupted in both our Universities, I had the opportunity of being acquainted with divers worthy persons, inquisitive into Natural Philosophy and other parts of humane learning; and particularly of what hath been called the New phi-

* See Note B.

losophy, or Experimental philosophy. We did by agreement divers of us meet weekly in London on a certain day, to treat and discourse of such affairs. These meetings we held, sometimes at Dr. Goddard's lodgings—on occasion of his keeping an operator in his house for grinding glasses for telescopes and microscopes, and sometimes at a convenient place in Cheapside, sometimes at Gresham College, or some place near adjoining. Our business was precluding matters of theology and state affairs, to discourse and consider of philosophical enquiries, and such as related thereunto, as Physic, Anatomy, Geometry, Astronomy, Navigation, Statics, Magnetics, Chymics, Mechanics, and Natural Experiments, with the state of these studies, as then cultivated at home and abroad: we there discoursed of the circulation of the blood, the valves in the veins, the venæ lacteæ, the lymphatic vessels, the Copernican hypothesis, the nature of comets and new stars, the satellites of Jupiter, the oval shape (as it then appeared) of Saturn, the spots in the Sun, and its turning on its own axis, the inequalities and selenography of the Moon, the several phases of Venus and Mercury, the improvement of telescopes, and grinding of glasses for that purpose, the weight of the air, the possibility or impossibility of vacuities, and Nature's abhorrence thereof, the Torricellian experiment in quicksilver, the descent of heavy bodies, and the degrees of acceleration therein, and divers other things of like nature; some of which were then but new discoveries, and others not so generally known and embraced as now they are, with other things appertaining to what hath been called the New Philosophy, which from the times of Galileo at Florence and Sir Francis Bacon (Lord Verulam) in England, hath been much cultivated in Italy, France, Germany, and other parts abroad, as well as with us in England."*

The principal members of the Society having retired to

* See Biog. Britannica, ed Kippis, vol. ii. p. 497. Note G.

Oxford after the king's death, their meetings were at first held over an apothecary's shop, "because" says Dr. Wallis, "of the convenience of inspecting drugs, and the like, as there was occasion," and finally "at the lodgings of the Hon. Mr. Robert Boyle."* In 1659, the Oxford members having principally returned to London, the weekly meetings of the Society were resumed at Gresham College. In 1663 they received the Royal Charter, by which they were formed into a corporation "for promoting natural knowledge."†

Such, gentlemen, were the objects and such the humble beginning of the oldest of all societies for the promotion of science; a society with which it is now a rare honour to be united, and which, unless we except its great rival the French Academy of Sciences, now merged in the French Institute, has contributed more than any other in the world to the progress of true philosophy.

The consideration of the character of Boyle seemed to be justly due to his extended influence and general merit. I proceed to speak briefly of his contemporaries who distinguished themselves more especially as Naturalists.

It will not excite surprise that of the natural sciences Botany should have been the earliest cultivated, when we reflect that its productions are on the surface of the globe and are more immediately accessible and useful to mankind. But it must excite surprise that in the course of so many ages, so little had been done in the collection and classification of plants. Theophrastus, a pupil of Aristotle, about 300 years before the Christian era, described only 500 plants. To these, Dioscorides, in the first century after the birth of our Saviour, added only 100. The elder Pliny, who wrote not long after him, mentions 1000; and the Arabian physicians in the 11th century not more than about 1400. From that period Botany shared the fate of

* Ut Supra. p. 498, Note H.

† See Note C.

knowledge in general, and continued in oblivion till revived by Otto Brunfels, early in the 16th century. Gesner, who died in 1565, by his practice of drawing flowers and fruit, arrived at the discovery that they were to be distinguished and classed by the organs of fructification. Improving on this hint, Cesalpini, a native of Arezzo, professor first at Pisa and afterwards at Rome, and who died at the commencement of the 17th century, was the first who invented a method in Botany. Previous to his time, plants had been arranged alphabetically according to the names given by the ancients, or in a manner still more arbitrary, according to the medicinal and often imaginary virtues which they were supposed to possess. His method was founded on characters derived from the form of the flower and fruit, and from the number of the seeds; and in his investigation of the internal structure of the latter, he compared them to the eggs of animals. This probably gave rise to the discovery of the sexual distinction of plants said to have been made by Millington, professor of Natural Philosophy at Oxford in 1675.* It was afterwards proved by the experiments of the younger Bobart in 1681, and those of Malpighi and Grew.

These two illustrious names remind me of a department in the history of plants, which they were the first to lay open, and which botanists at the present day are exploring with equal ardour and success; I mean the anatomy of plants or vegetable physiology. Malpighi and Grew were born the same year,† and were students of nature from their earliest years. The Italian philosopher, being called to the University of Pisa in 1656, was induced by his intimacy with the mathematician Borelli, to perceive the futility of scholastic philosophy, and the importance of experiments as the only sure foundation of science. His examination of the human viscera, and into the anatomy and transformation of the silk worm, and the development

* See Note D.

† 1628.

of the chicken in the egg, led him to investigate the structure of plants, from a suspicion that there might be a similitude in their vital and productive functions.* It is very remarkable that Grew arrived by the same process of reasoning at the same conclusion. In the preface to his anatomy of plants he says, that he was led to that subject "upon reading some of the many and curious inventions of learned men in the bodies of animals. For considering that both of them came at first out of the same hand, and were therefore contrivances of the same wisdom, I thence fully assured myself that it could not be a vain design, to seek it in both." As there was no intercourse between Malpighi in Italy, and Grew in England, it is evident that neither could have borrowed from the other. The experiments of Grew were made from 1664 to 1670; those of Malpighi after his return from Messina to Bologna in 1666. Both were acute and original observers; and the coincidence of these independent witnesses evinced the accuracy of their testimony. Malpighi had the livelier imagination, and, in the formation of his theories, was more under its influence.† The works of Grew are a storehouse of facts, which seldom require correction excepting where theory is interwoven with observation.‡ We have seen that both arrived at the important discovery of the sexual distinction of plants. Indeed Pulteney affirms that Grew was the first in England to perceive the universal application of this doctrine to the vegetable kingdom.§

At first, however, it was not received universally, nor by those who did adopt it was it received without hesitation. Ray, the greatest English Botanist of his age, who was born the same year with Malpighi and Grew, spoke of it at first as only probable, and only by degrees did he be-

* Fabroni Vitae Italorum, vol. iii. pp. 165 and 167, In explicando &c. Biog. Univ. vol. xxvi. p. 408.

† Biog. Univ. vol. xxvi. p. 409.

‡ Rees' Cyclop. vol. xvii. art. Grew, written by Sir James Edward Smith.

§ As quoted in Biog. Univ. vol. xviii. p. 467.

come fully convinced of its importance. In France, Tournefort his great rival openly denied it, and looked upon the stamens as only excretory vessels. The principal objects of Ray and Tournefort were to enlarge their collections of plants, to describe them accurately, and to class them with precision and clearness. The advantages resulting from the labours of Ray were great. Natural families of plants were better defined, the distinction of complete and incomplete flowers rendered more precise, the grand division of Monocotyledons and Dicotyledons well established. His catalogue of English plants laid the foundation of the English Flora; while his catalogue of European plants which did not grow in England, and which he had classified according to the regions in which they grew, furnished a very curious sketch of the botanic geography of Europe. He condensed with singular ability the principal discoveries of his predecessors together with his own, and the first book of his General History of Plants, says Cuvier, should be republished separately, as a just monument to his memory, and as being the most complete treatise we have even now of the whole of vegetation.*

In the interval between the publication of the first two and the last volumes of Ray's History, Tournefort in 1694, published at Paris his Elements of Botany.

In the correspondence to which this led between Tournefort and Ray, the effects were honourable to both parties. Tournefort amended what his great rival proved to be erroneous, and Ray combined the method of Tournefort with that of Rivinus in founding the principal divisions of his second method on the flower. The greatest defect in both systems was the retaining, in obedience to the prejudices of the times, what Rivinus had laboured hard to reject, the distinction of plants into trees, shrubs, undershrubs and herbs. The English and French writers are not yet agreed as to the question of pre-eminence between

*Biog. Univ. vol. xxxvii. article Ray, by Cuvier and Du Petit Thouars.

these distinguished men.* It is certain however that without the labours of Tournefort, Ray would not have formed his second method, and that Tournefort's system, by its genera, and his mode of naming the species, prepared the way for that of Linnæus.

We have hitherto considered Ray only as a Botanist, but his labours in Zoology are still more important, because that science had been much less cultivated than that of Botany.

The history of Animals by Conrad Gesner, of Zurich, published from 1551 to 1587 was the foundation of all modern Zoology.† Copied almost literally by Aldrovandi, and abridged by Jonston, it has been rifled of its erudition by many a celebrated author who has not thought it necessary to acknowledge the source of his riches. In this great work not only were the animals named in different languages ancient and modern, and a description given of their forms, the countries they inhabit, the duration of their lives, the diseases to which they are subject, their habits and instincts, but there were also enumerated the figures of poetry and eloquence they had furnished, the epithets bestowed upon them, and, in a word, all that ancient writers or those of the middle ages had said concerning them. In addition to this, Gesner related all that he himself had noticed, or that had been communicated to him by his correspondents.

Aldrovandi, who died in 1605 at the age of 78, employed almost the whole of his long life in collecting materials for his Natural History. It consists of thirteen folio volumes; and though it is a compilation without taste and genius, yet, as it contains every thing which had been said on the subject previous to his time, it is not without its use as a work of reference.

*See for the English, the article Ray in Rees' Cyclopedia, written by Sir J. E. Smith, and for the French, the article Ray, in the Biographie Universelle.

†Biog. Univ. vol. xvii. art. Gesner, p. 242, written by Cuvier.

Hitherto no naturalist had thought of departing from Aristotle's Classification of Animals. It was reserved for Ray to adopt a better method founded on the structure of the heart; and to this he was led by the Harveian experiments and the doctrine of circulation. The mode of breathing in animals, whether by lungs or by gills, and, in the former case, the single or double structure of the heart, constituted the basis of his system. It is proper to notice, that his gratitude to Willughby, who had been his pupil at the University and with whom he had travelled for three years,* was the occasion of his labours in this branch of Natural History. Willughby had turned his attention chiefly to birds and fishes; but in 1672 he was cut off, at the early age of 37, leaving his papers unfinished. These were digested and published by Ray; the Ornithology in 1676, the History of Fishes, ten years afterwards. These works comprise all that had been done previously by Belon, Rondelet, Gesner, Aldrovandi, Olina, and Margrave, and all that Willughby and Ray had themselves observed in Germany and Italy. Cuvier remarks, that "the fishes of the Mediterranean especially, are described with rare precision, and are found with more facility in Willughby's work than in that of Linnæus." "Ray's own work on quadrupeds and serpents, published in 1693 and the synopsis of birds and fishes published after his death by Derham, as well as the History of Insects published by the Royal Society, have had a very important influence over the subsequent progress of natural science." "The peculiar character of the labours of Ray" he proceeds to remark, "consists in clearer and more rigid methods than those of his predecessors, applied with greater constancy and precision. The distribution he introduced in the classes of quadrupeds and birds has been followed by English naturalists almost to the present day, and has influenced the classification of Linnæus and Buffon. The

*From 1663 to 1666.

latter extracted from Willughby all the anatomical part of his history of Birds. Daubenton and Haüy have also in great part translated his articles on fishes." Ray was truly a Christian Philosopher; and his noble work "on the Wisdom of God in Creation," has been universally admired, for its piety as well as its philosophy. He there inculcates the advantage, and even the duty, of contemplating the works of God. "This" he says, "is part of the business of a Sabbath day, as it will be, probably, of our employment through that eternal rest of which the Sabbath is a type."*

Time will not permit me to dwell on the labours of Redi and Leewenhoeck, and I pass over them the more readily that I may dwell longer on those of Swammerdam and Ruysch.

Swammerdam devoted himself to anatomy; and he was the inventor of the method of injecting melted wax of different colours into the veins and arteries, and thereby rendering them more visible and the dissection of them easier. His anatomical studies having been interrupted by a fever, on his recovery he abandoned the examination of the human frame, and confined himself to entomology. With wonderful skill and patience he dissected the most minute parts of the minutest insects. For this purpose he made use of small ivory needles which he himself had sharpened by means of the microscope; and it is impossible to be more exact than he was in separating without tearing the organs of these little animals, or in describing their structure. The discoveries which he made were consequently numerous and important, and before his time, entirely unknown. These labours finally deranged his intellectual faculties; and in one of the paroxysms of his disorder he threw the greater part of his manuscripts into the fire. Happily his history of insects escaped this fate, and nearly sixty years after his death was published by

*Rees' Cyclo. vol. xxx. art. Ray.

the great Boerhaave. His secret of injecting wax into human bodies he communicated to his countryman Ruysch, by whom it was carried to a wonderful degree of perfection. The subjects he prepared had more the appearance of living persons than of dead bodies, and even in cases where putrefaction had commenced, his preparations effectually overcame the corruption, and removed all that could offend even the most delicate nerves.* It is related of the Czar Peter the Great, that while examining the cabinet of Ruysch, he could not refrain from kissing with transport, the prepared body of a little child who seemed to smile upon him. Ruysch lived to the age of 93, and he had the satisfaction of seeing that his preparations were uninjured by time. Unhappily he suffered his secret to die with him, and all subsequent attempts to arrive at the same perfection have been hitherto unavailing.

For the honour of the sex, I must here mention the name of Maria Sybilla Merian, daughter of Matthew Merian the engraver, the partner and son-in-law of the famous Theodore de Bry.† She was from her childhood familiar with the fine arts, and with the study of nature. Under the instruction of the painter Morell, her mother's second husband, and that of Mignon, she became eminent in miniature and in drawing flowers and insects. After visiting various cabinets of Natural History in Holland, her passion for such studies led her to cross the ocean in 1699, accompanied by one of her daughters, to the Dutch Colonies in America, whence she returned in 1701 with a beautiful collection of drawings of insects, shells and plants. She published a part of these treasures at Amsterdam in 1705, and the copies coloured by her own hand possess a surprizing beauty. To complete the work, her eldest

*See the account of his injecting the body of Admiral Berkley in 1666. Although the body was in a state of putrefaction when it came into the hands of Ruysch, under his skillful treatment it was sent back to England as fresh as the body of a newly deceased infant. Biog. Univ. vol. xxxix. p. 381.

† Born 1647, died 1717. Biog. Univ. vol. xxviii. p. 366.

daughter again visited Surinam, and sent her drawings and descriptions to her mother. The publication was suspended by her death, but was afterwards given to the world by a younger daughter under the title of the History of Insects of Europe and Surinam. Many of Maria's drawings on vellum are still preserved in the British Museum, at St. Petersburg, in different cabinets in Holland, and at Francfort, her place of residence.

Having mentioned shells, I am led to speak of the labours of Lister which come within our first period.* He was born about 1638, and the first edition of his history of shells in 2 vols. folio was published from 1685 to 1693. The drawings were made under the eye of the author by his two daughters; and this edition of the richest and most important work of its time has become extremely scarce and valuable.

We have now arrived, gentlemen, at the end of our first period; and even from this brief and meagre survey, you have seen that it was only a season of preparation for more important labours. Natural History had indeed been the subject of many a learned work, but it had never been considered as a whole, nor pursued upon one uniform plan. No complete catalogue had been attempted, nor were the descriptions so precise and clear that the individual being or thing studied might at once be referred to its proper place in the system. Names had been assigned by each author according to his own theory, or caprice, or inclination; and hence descriptive phrases were of necessity employed which even the most tenacious memory could not retain. It was necessary then to form a method of distribution capable of embracing all the beings in nature; but founded on such striking characteris-

*Biog. Univ. vol. xxiv. p. 569.

tics that resemblances and dissimilitudes might at once be perceptible. Numerous terms were to be invented to indicate the prodigious varieties which exist in creation, so simple and so definite that the use of them could never be uncertain. In a word, it was necessary to take a general review of all that preceding authors had done; of all that could be gathered from voyages and travels, or collected from the various European cabinets. An index of the whole circle of Natural Knowledge was to be formed, according to one conventional method, one established terminology, and convenient and invariable names. For this purpose a master spirit was wanting; and that spirit now arose, to illumine what was dark, and harmonize what was discordant.

In 1732, a poor and friendless stranger from a little town in Dalecarlia, presented himself at Leyden to the *illustrious* Boerhaave. His indigence was so great that when in College he had been obliged to wear the cast-off shoes of his fellow students; and though after he had left Upsal, he gained a little money by the practice of medicine, yet by the time he arrived at Hamburg all his resources were exhausted. He persevered however in making his way to Holland; and the great physician whom I have named, recommended him to a rich proprietor of the name of Clifford who had a taste for Natural History, and possessed, at Hartecamp between Leyden and Haarlem, a magnificent garden, cabinet, and library. In this hospitable abode he remained for three years, enjoying abundantly all the assistance necessary for his favourite studies. Need I tell you, that this poor stranger, thus indebted to the munificence and love of science of one rich individual, was the great Linnæus!

In 1735 was published at Leyden the first sketch of his System of Nature, or the three kingdoms of nature systematically set forth, by classes, orders, genera and species. It consisted of three tables, each contained in a

single sheet; and this, with another treatise of 26 pages published the following year, contained the germ of all that he afterwards wrote. This work of 26 pages contained, in the form of Aphorisms, the theory of Botany; and it was the result, as the author informs us, of seven years' study, and the examination of 8000 plants. It was followed in successive years by three other works which laid the foundation of the great revolution in Botany; and fifteen years afterwards, the whole was condensed in an octavo volume, containing proofs in every page of the most subtle intellect, and a most astonishing depth of observation. This single volume has become the fundamental law, the constitution, as it were, of the science; a constitution acknowledged and reverenced by botanists of every nation; and notwithstanding the immense quantity of plants since accumulated, and the innumerable facts which skilful observers have since added, principally on vegetable anatomy and the internal structure of fruits and seeds, the system of Linnæus is even now in full vigour.*

It has become indeed in some sense a universal language; and in every country, however remote, where a scientific botanist, or even a skillful gardener is to be found, it is sufficient, in order to be understood, to designate a plant by its Linnæan name. It was not, as we have seen, the discovery of the sexual system which gave Linnæus his fame and his sovereignty. That discovery is claimed by England; and it preceded the time of Linnæus half a century. It was rather the distinctness, the regularity, the energetic precision of his system, and especially the convenience of what he called the *trivial*, or, as it is now termed, the *specific* name, which gave him this authority. This last simple contrivance alone, by which the overburthened memory of the Botanist was relieved from the constant accumulation of long descriptive phrases, was found so useful, that dating from that epoch, he reigned over the Botanic world without a rival.

* See Note E

But however important may have been the influence of his methodical mind over the vegetable kingdom, its influence, in the judgment of no less a man than Cuvier, has been still happier, over that of animals. Zoology being at that time less cultivated than botany, his supremacy became more established in the latter science; and the fame of Buffon soon became so brilliant as to pale all other fires. The merits of his labours in this department have, therefore, been more recently perceived, and more tardily acknowledged. Indeed it is principally to the magnanimity of Cuvier, too great himself to be jealous of another's fame, that the world is indebted for the explicit recognition of Linnæus, as the model and the legislator even of the Animal kingdom.

With regard to Mineralogy, his merits were far inferior, even in his own estimation; and his countryman and contemporary Wallerius, was justly considered, in Sweden as well as in the rest of Europe, to be the dominant genius of the age. But Mineralogy is so intimately connected with Chemistry, that during the infancy of the latter science, its progress was of necessity slow; and I purposely reserve any remarks upon it, till we arrive at a later period.

In the year 1741, Linnæus was appointed professor of Botany in the University of Upsal; and he continued to discharge the duties of that chair, for the long term of 37 years. His pupils became his zealous friends; and laboured under his direction, in extending the domains of natural science. By his influence with his own and foreign governments, they were placed as chaplains, or surgeons, on board the national vessels, or sent, expressly as naturalists, on voyages of discovery into the remotest regions of the earth. Kalm came to America; Hasselquist went to Palestine and Egypt; Torenius to the Indies; Osbeck to China; Lœfling to Spain; Thunberg to Japan; Forskal to Arabia; Sparrman, to the Cape of Good Hope; and Solander circumnavigated the world with Cook.

All were emulous to enrich the cabinet of their illustrious master; and foreign naturalists, of every clime and nation, considered his correspondence an honour, and took delight in contributing to augment his treasures. Nor did his influence stop there. His systems and his nomenclature having passed into general use, a taste for Natural History became almost universal. Governments and rich individuals throughout Europe, established cabinets and gardens, and collected specimens at great expense from every part of the globe. Sweden led the way, and was soon followed by Austria, Russia and Denmark, in exploring their own territories, or sending naturalists into foreign lands. Science took a bolder flight. Academies and Societies in continually increasing numbers, did homage to the great Naturalist. Sovereigns became his correspondents, and invited him to their courts. And he lived long enough to enjoy the rich reward of all his labours, in the consciousness that they formed decidedly the most important epoch in the history of natural knowledge.

But important as were the labours of Linnæus, there was one defect in his system, which he himself acknowledged, and sought to remedy. Its arrangement is artificial, founded on the number, the position and the proportions of the stamens. If adhered to rigidly, it leads to incongruities; for it is obvious, that plants may be similar in the organs of fructification, and yet be as unlike as possible in the general analogies of their structure. In a word, a natural arrangement was wanting.

If we possessed a complete collection of all the plants which grow in every clime and every soil of the earth, it would then be possible to arrange them all, according to their natural divisions into various tribes and families.

And under these general heads, the system of Linnæus would serve as an admirable arrangement, by which a single human mind might be enabled to comprehend the whole. Here then we at once perceive what Linnæus left undone, and what remained for future botanists to accomplish.

The honour of the most complete attempt at the formation of a natural system is due to the celebrated French botanist BERNARD DE JUSSIEU. He was eight years older than Linnæus, and died two months before him. He seems to have conceived the vast idea of his method of classification quite as early as the first publication of the system of Linnæus; and it is very probable, that the tender friendship and intimate and unreserved communication between these great rivals, when, in 1738, Linnæus visited Paris, might have induced the latter to turn his thoughts also to a natural arrangement.* Though warm friends there was the utmost difference between them in point of character. Bernard de Jussieu was entirely indifferent to fame. He loved science for its own sake; and freely communicated, to all who approached him, the results of his most acute and extensive observations. When told that some one of his discoveries had been published by another who took the credit of it, his reply was, "What do I care, provided the thing is made known!" He cared little for method; and when asked to recommend one to the celebrated J. J. Rousseau, he replied, "Let him study plants as nature presents them to his notice. Let him class them according to the affinities which his own observation will discover. It is impossible that such a mind should be employed about botany, without giving us some new information."† One so indifferent to fame, and so occupied in observation, would have little leisure, and less inclination, for writing. We are indebted therefore for

* See Note F.

† Biog. Univ. vol. xxii. p. 165.

what we know of his system to the *Genera Plantarum* of his Nephew, Antoine Laurent de Jussieu, published in 1789. The world still expects from the author, yet numbered among the living, a second edition of his important work, rendered necessary by the immense discoveries made since its publication.

It has already been observed that a complete natural arrangement must be the result of a complete collection of plants. We can arrive at it, therefore, only by continual approximation; and for this purpose the efforts of Botanists have been and are still directed with a steady aim to this great object. If Jussieu reckoned only one hundred families, we must now be acquainted with at least two hundred.* The number of plants now known and systematically arranged amount, it is said, to upwards of 50,000; and when it is remembered that Linnæus formed his system on the examination of not more than 8000, it will at once be seen that the progress made in the last hundred years has been wonderfully accelerated. It may be called the age of discovery; as that which preceded it was the age of classification. The gardens of Great Britain are now among the richest and most celebrated of modern times; and in that little island, though the number of native plants did not originally exceed 2000 species, there are now in actual cultivation more than 30,000, and their number is every day increasing. De Candolle is of opinion that if the central regions of Asia, Africa and New Holland, were as well explored as the countries of Europe, there would be found above 100,000 species of plants on the Earth's surface.† This of course is a conjecture, but it is probable; and we therefore see how much remains to be done.

Among the subjects which engage the attention of bota-

* See Note G.

† Elements of the philosophy of plants, by De Candolle and Sprengel. Edinb. 1821, 8vo. p. 81.

nists of the present day, must be named what the French have properly called the geography of plants; the consideration of the parallels of latitude in which they grow, their altitude above the level of the sea, the difference of the soils which produce them, the analogies of those which grow in opposite hemispheres, and the comparative organization of those which are the most, or the least, widely distributed. Some authors have, with great advantage to the science, confined themselves to the collection and description of particular families and genera. Thus the Fungi, the Algæ, and the Fuci, the Lichens, the Mosses and the Ferns, the Aloes, the Pines, the Willows and the Oaks, the umbelliferous, the cruciform and leguminous plants, have all had their respective votaries. This, division of labour has greatly increased the accuracy and extent of our knowledge.*

The anatomy and physiology of plants have thereby been more actively investigated. After the labours of Grew and Malpighi, this branch of science remained for some time stationary. It was revived by Hedwig, and Gaertner, each of whom added greatly to the amount of discovery.† They have been followed by Krocker, Sprengel, Rudolphi, Kieser, Senebier, Keith and many others. It has of late attracted still greater attention; and I might enumerate many distinguished men who are thus occupied; Brown and Lindley of London, Sir W. J. Hooker of Glasgow, Greville of Edinburgh, Du Trochet and Mirbel of Paris, De Candolle of Geneva, Savii of Pisa, and Amici of Florence. The last named philosopher, by means of his powerful microscope, is continually advancing as an explorer of the mysteries of nature, and displaying to our admiring view, the wonderful, but hitherto unseen works of God.‡

When we rise from the consideration of the life and or-

*See Note H.

† See Note I.

‡ See Note K.

ganic structure of plants to that of Animals, our subject increases in extent, variety and value, 'till it terminates in MAN, the earthly lord of creation. We have seen that the system of Linnæus published in 1735, was even happier in Zoology than in Botany. Its merits however were not at that time fairly understood, because the number of scientific Zoologists was much less than that of Botanists, and mankind in general love a more amusing form of instruction in proportion as the actual amount of their knowledge is less. In 1734, Réaumur began to publish his work on Insects, written in a style so charming as to unite with the accuracy of history all the attractions of Romance. It was continued 'till 1742, when the 6th volume appeared, but his death, in 1757, unhappily left the work unfinished, and his manuscripts were found to be so disordered and incomplete, as to be unfit for publication. His collections passed into the Cabinet of the Royal Garden, concerning which we have now to speak.

For nearly a hundred years the Royal Garden of plants at Paris, the establishment of which was coeval with that of our City, was greatly neglected, and its revenues were appropriated to other objects. But in 1732, the superintendence of it was separated from the office of the first physician to the king, and confided to Charles François Du Fay, who soon rendered it the finest garden in Europe. He died in 1739, and on his death-bed, recommended Buffon as the only man who seemed to him capable of following out his plans. Buffon was a few months younger than Linnæus, and survived him about ten years. Their characters were essentially different. Linnæus was methodical, patient, concentrating, and concise; Buffon despised system, was brilliant and imaginative, diffuse and fond of ornament. Eminently fitted to render a subject popular when the materials were collected and laid before him, he was utterly incapable of that minute, and accurate, and unwearied observation, which are so essential to the

science of the naturalist. Happily he had for his associate Daubenton, whose qualities were precisely those in which Buffon was defective. The collection of facts with which he enriched the history of animals is immense; and the care with which he observed them was so great, that Cuvier has given him a praise, which from any other mouth would have seemed extravagant: IN VAIN DO WE LOOK FOR AN ERROR. He described only what he had seen himself. He did not even draw those general conclusions which most naturally arise from established facts; and his timidity in this respect was so cautious, that Camper said of him, he did not himself know how many discoveries he had made.

It was unfortunate for the interests of science, that Buffon appears to have treated him unkindly in permitting an edition of the History of Quadrupeds to be published, in which the descriptions and anatomy of Daubenton were suppressed. In consequence of this, he refused any further co-operation in the work; and in the history of birds his place was poorly supplied by Guineau de Montbelliard and the Abbé Bexon.

After what has been said of Buffon, it will no longer excite surprise that, in the popular estimation, his fame should so entirely have eclipsed that of Linnæus. Another cause of his celebrity was, the advantage he possessed in the superintendence of the Garden of Plants, and the facilities afforded him for forming collections in a city which had become the capital of the scientific world.

Two schools of Natural Science were now formed; the one, pursuing the system of the Swedish naturalist; the other, following the more popular course of the brilliant Frenchman.

Time would not permit me to do more than name the individuals who formed these respective schools; and I therefore purposely omit them, lest among so many, I should commit injustice by selection. From 1735 to 1798, when

Cuvier published his first work, twenty-eight authors are enumerated on Entomology alone;* each of whom had contributed, more or less, by their observations, to enrich the history of Insects. Of these, there were, one Italian, two Danes, three English, three French, three Swedes, three Swiss, four Dutch and nine Germans. In the other departments, authors have not been so numerous, but the whole science has been carried forward with an impetus truly astonishing. The French, the Germans, and the English have vied with each other in this generous and noble rivalry.

If the French have surpassed all other nations, it must be attributed to the possession of such a treasure as their Cabinet of Natural History. It may be said to have been created by Daubenton, and has ever since been continually augmented, by the zeal of individuals and the patronage of government. Even in the stormy times of the Revolution, when a political frenzy seemed to have seized the whole nation, this splendid monument of science, though for a time neglected and deprived of its support, was spared and finally patronized. It was in the spring of 1795, that Cuvier first visited the French capital, and in July of the same year, was appointed assistant lecturer of Comparative Anatomy in the Garden of Plants. Here, in a lumber room of the Museum of Natural History, he found four or five old skeletons, collected by Daubenton, and cast aside by Buffon.

It is interesting to trace from their commencement the history of noble institutions, and to see how much can often be done by the perservering industry of a single individual. These skeletons Cuvier made the basis of his museum, and, encouraged by some professors, though opposed by others, went on in the formation of it with untiring effort. In less than forty years, and within the compass of his own invaluable life, that museum, Gentlemen,

* See Duméril.

has become one of the wonders of the age, and together with its immortal author, has created a new epoch in the history of natural science.

In 1798, he published his elementary "Tableau" of the Natural History of Animals, and from 1800 to 1805, his lectures on Comparative Anatomy. To this latter work, the French Institute in 1810 awarded one of the great prizes of the first class in the celebrated "Prix decennaux," instituted by Napoleon.* These works, however, were only preparatory to those which formed the subsequent labours of his life. In 1817, appeared the first edition of his "Animal Kingdom," and twelve years afterwards a second edition, in which he availed himself of all the contributions to natural knowledge made during that interval. The mind of Cuvier was too great to be influenced by a petty jealousy; and he was at all times ready to receive and acknowledge the aid of his fellow labourers. What they examined and perfected in detail, his vast comprehension admitted and adjusted to its proper place in the system. Thus the last edition of his "Animal Kingdom" has brought up the subject of Zoology even to a higher level than that of Botany; and all succeeding discoveries will probably be arranged according to the classification which he has established. It has been formed on such just and philosophic principles—it is so true to nature, being founded not only on the likeness of external forms, but also on the most exact analysis of internal structure—that, although its subdivisions may be rendered still more exact by future discoveries, yet, as a whole, it can hardly be superseded.

According to that classification, the whole of Animal nature, from Man down to the lowest Zoophyte, is modelled by the Almighty according to four principal forms: the VERTEBRATED, the MOLLUSCOUS, the ARTICULATED, and

* See the very curious collection, entitled "Rapports et discussions de toutes les Classes de l'Institut de France." Paris, 1810, 4to.

the RADIATED. The Vertebrated animals are those which have skeletons as a kind of frame work to the body, covered generally with muscles, and containing the viscera in the head and trunk. The Molluscous, are those which have no skeletons, but in many species are furnished with shells. The muscles are attached to the skin, and they have a nervous system and viscera. The Articulated form comprises crustaceous animals, insects and worms, and their envelope has rings, with either soft or hard teguments, to the interior of which the muscles are attached. The Radiated, comprises those animals which, from their resemblance to plants, are known by the name of Zoophytes; of which the organs of movement and sensation are not, as in the other three, arranged symmetrically on the two sides of an axis, but disposed in rays around a centre.

The Vertebrated animals are subdivided into four classes, characterised by the kind or power of their motions: the Mammiferous, including man and quadrupeds, Birds, Reptiles, and Fishes. The Molluscous, are subdivided into six classes; an arrangement peculiar to Cuvier, and founded on their internal organization. Most of these are marine animals, and the greater part have shells. The Articulated, are subdivided into four classes; the Annelides or red blooded worms, the Crustacea, the Arachnides, and the Insectæ. The first of these classes has been established by an early discovery of Cuvier, the last three, were united by Linnæus, in violation of all natural order, under the general name of Insects. The Radiated, or Zoophytes, are subdivided into five classes: the Echinodermata, so called from their spines, the Entozoa or Intestinal worms, the Acalepha or Sea Nettles, the Polypi, under which are ranged, perhaps improperly, Corals and Sponges, and lastly the Infusoria, or those minute beings which swarm in fluids, and can be seen only with a powerful microscope.

To pursue the subject farther, by shewing how all these classes are again divided into orders, families, genera and species, would carry us beyond the limits of our present employment. I shall merely mention, therefore, to shew how much has been done for the advancement of the science, that, in the preparation of the great work to which Cuvier devoted his last years, and which his death in 1833 left unfinished, I mean his Natural History of Fishes, he had accumulated more than 5000 species. When it is considered, that less than one hundred years ago, Linnæus determined only 477 species, and that even so lately as 1799, De la Cepède enumerated only 1500, the immense amount, added to our knowledge within the last thirty-six years, must strike every one with astonishment.

There is one discovery proceeding from the application of Comparative Anatomy, which first established the transcendant fame of Cuvier, and which I have reserved to be mentioned last, because it leads me to the third division of our subject, the consideration of inanimate, as distinguished from living nature.

In digging into the earth's crust, there are two methods of considering what we find there. In the one, we analyze and classify all that can enter into the composition of unorganized bodies; in the other, we consider these bodies in their relative positions, their character as portions of the globe we inhabit, their modifications under the influence of the mighty mechanism of secondary causes. The one is called MINERALOGY; the other, GEOLOGY. I shall begin with the latter, on account of its connexion with the fame of Cuvier.

The practical knowledge of this branch has been as old as the attempts of man to explore the hidden treasures of the earth; and the regular formation and succession of strata, together with the disturbances occasioned by earthquakes, volcanoes, and inundations, have been remarked

at a very early period. The existence also of organized bodies in a fossil form, embedded in several of these strata has been for centuries the occasion of wonder and perplexity. I should weary my hearers were I to tell them of all the crude conceptions, and absurd fantasies, invented to account for these phenomena. They were such as absolutely to bring Geology into contempt; and it was by many regarded as a visionary employment of the human intellect, 'till the work of Cuvier on Fossil organic remains, gave it a new character, and produced throughout the world the sensation of a surprising discovery.

The method of considering each separate organ, and tracing it through the whole series of animals, had led him to certain general and invariable laws of combination, by which the possession of one series of bones would indicate the necessary connexion of another series. A beast of prey for instance, would always have teeth fitted to devour that prey, and claws fitted to seize it. A ruminating animal, on the contrary, would have hoofs instead of claws, and teeth fitted only to grind its vegetable diet. In this way, the possession of even the fragments of an animal, would enable him to complete its whole structure, and determine to what genera or species it belonged.

Aided by M. Brogniart, an eminent geologist, Cuvier commenced his researches at Montmartre, and in the quarries of gypsum in the environs of Paris. These had, for many centuries, furnished the building stone of that metropolis, and had been sunk to the distance of two hundred and forty-three Paris feet. About fourteen or fifteen feet below the surface there are strata of marine formations, attesting the presence of salt water, which have altogether a thickness of nearly seventy-seven French feet. Below these, incontestible proofs exist of a soil anciently inhabited by quadrupeds of different species, reptiles, birds and fresh water fish. Below these, are still deeper strata containing productions of the sea. By collecting the scatter-

ed bones of these animals and reproducing their forms, according to the unerring rules of anatomical science, Cuvier discovered one hundred and sixty-eight vertebrated animals, forming fifty genera, of which fifteen are no longer in existence. Many of the individuals, even of existing genera, are of enormous size; and, what increases the wonder, they are such as are now found only in other regions and other climates. No trace was found of human skeletons, or of the order quadrumana. Almost the entire skeleton was discovered of a species of opossum, an animal which now exists only in America; and this single fact at once overturned the theory that the American genera had come from their own soil, and had never extended themselves to the other portions of the globe.*

I shall add no more on this subject, excepting to state, that all the subsequent researches of geologists, of every nation, have confirmed the truth and the importance of this great discovery. The natural evidences of a sudden and universal deluge, and the probability of the Mosaic Chronology, have been set forth with a force of truth which has borne down all opposition; and although there are still great and very embarrassing difficulties to check the pride of human knowledge, the Christian philosopher is encouraged to wait with patience, 'till some other bright discovery shall

"Vindicate the ways of God to man."

What Cuvier has been to Geology, the Abbé Haüy was to Mineralogy. In speaking of the Systema Naturæ of Linnæus, it was observed, that his Mineralogy was the least perfect of all his methods. His classification depended solely upon external forms; and 'till a late period he did not even recognize the importance of Crystallization.

* See Note L.

Indeed, we can hardly date the commencement of Systematic Mineralogy as older than the year 1774, when Werner first published his celebrated work on the external character of Minerals; and as that work was not translated into French 'till 1790, or into English, by Kirwan, 'till 1794, we may fairly consider the general impetus given to the subject as coming within the compass of the last forty-five years. During the same period, the New Chemistry, which dates from the elementary treatise of Lavoisier published in 1789, has made a wonderful progress. Many delicate and difficult analyses have, by its aid, led to a more perfect knowledge of the nature, and number, and various combinations of simple substances. A course of laborious experiments on Crystallization by M. Romé de l'Isle in 1772, was a first, though feeble step to the splendid discovery of Haüy, of which we have now to speak.*

Haüy commenced the world as a Chorister, and studied Natural Philosophy and Botany as amusements. One day at the Garden of Plants, accidentally passing by the lecture-room of Daubenton, he stepped in, and heard a lecture on Mineralogy. From that moment he began to study the science. By a like fortunate accident, while examining a beautiful group of calcareous spar, he let it fall; and the fracture of one of its prismatic crystals produced in his mind a train of thought, by which he finally became the legislator of Mineralogy, and the founder of a system which has been adopted throughout the world.

The Crystallization of Minerals takes place when such substances are dissolved in any fluid; and it is one of their most constant and invariable characters. It is, in some measure, with regard to them, what organization is with regard to Animals and Plants. All the Crystals belonging to the same species of Minerals have one common primitive form,—a specific nucleus, around which all the matter

* See Note M.

of which the crystal is composed lies in parallel laminæ, decreasing towards their angles by the subtraction of integral particles. By thus anatomizing, as it were, the various crystals pertaining to the several species, Haüy was enabled to ascertain the laws according to which they are invariably formed. Hence resulted the distinction of six primitive forms, the Cube, the Tetraedron, the Octohedron, the Hexangular prism, the Rhombic dodecaedron and the Dodecaedron with equilateral, isosceles, or scalene triangular faces. By a further mechanical analysis, these primitive forms were reduced to three Integral elements, to which he gave the name of Molecules. These are, the Parallelopiped, the Triangular prism, and the Tetraedron or simplest pyramid, bounded by four faces. By the superposition of laminæ upon these *Primitive* forms, decreasing from their edges, or angles, is produced an almost infinite variety of *Secondary* forms. In calcareous spar, for example, of which the primitive form is a rhomb, there have been actually enumerated fifty-nine modifications; which, being differently combined, give rise to six hundred and sixteen varieties; and Haüy asserts, that from the Rhomb alone, by a decrement of four ranges on its edges and angles, might be produced, eight millions, three hundred and eighty-eight thousand, six hundred and forty varieties of Secondary forms! Such is the connexion of fecundity and simplicity in the works of God!

The distribution of classes, orders, genera and families, which subdivides this method, is founded solely on external characters and chemical results; but the lines of separation of the *species* are traced by the forms of the integral Molecules. With this primitive form in each mineral, are to be considered its various chemical and physical properties, such as specific gravity, hardness, refraction, phosphorescence, electricity, dissolution by acids, and many others. The varieties are described in two series: first, of crystalline forms properly so called, and secondly, of

forms resulting from disturbed crystallization.* To all this he subjoined the history of each species, all that could be known of its relative position in the earth, and its uses for the wants or enjoyments of life.

The system of Haüy, with very few modifications, is now the standard employed in classification and arrangement; and all subsequent discoveries have served only to elucidate, more and more, the great principles which he established.

Having thus considered the state of the Natural Sciences in Europe, if we turn to the consideration of what has been done in America, we shall find that, until a very late period, every part of Natural History has been left to the solitary effort of zealous individuals. The situation of the Colonies, from their settlement down to the close of the Revolutionary war, was not favourable to the cultivation of the Natural Sciences; and during that whole period, with the exception of the elder Bartram of Pennsylvania, and Clayton of Virginia, scarcely a native American can be named, who distinguished himself in his intercourse with the Naturalists of Europe.†

But with our existence as a nation, came the spirit of enterprize, and the pride of national character. Our physicians now strove to emulate the fame of European practitioners; for to the medical profession, in every age and every country, must be given the high praise of being the earliest promoters of Natural Science. Our Colleges now began to aspire to the character and rank of Universities. The increasing opulence of our merchants led to the establishment of splendid country seats and extensive and well cultivated gardens and farms. The facilities of commercial intercourse opened the way to the advantages

* See Note N.

† See Note O.

of foreign travel. Our nation has advanced with unexampled rapidity in intelligence and refinement, and these have brought with them, as their inseparable companion, a more extensive cultivation of the Natural Sciences. The two Bartons of Philadelphia, Muhlenberg of Lancaster, Elliot of South Carolina, distinguished themselves in Botany. Peale of Philadelphia, collected his splendid museum of Zoology, and the elder Scudder of New York, who was eminently skilful in preserving animals, emulated his example. Dr. Mitchell, of the same City, formed a desultory collection, which at his death he bequeathed to the New York Lyceum of Natural History. Dr. Waterhouse and Professor Peck of Harvard University, deserve to be named, as having enlightened the public taste, promoted discovery, and formed collections. Dr. Hosack, it is said, on his return from finishing his studies in Edinburgh, was the first who brought to this country a cabinet of minerals. In 1790, Smith of Philadelphia, formed a small collection, which passed into the Cabinet of the American Philosophical Society. About the year 1802, Dr. Seybert, of the same city, brought from Germany a small but valuable collection. About the same time, Benjamin D. Perkins introduced another, which was purchased by Yale College. In 1803, Dr. Bruce of New York returned from Europe with one of the completest collections which had then been seen in this country; and in 1805, the late Col. Gibbs brought his extensive and magnificent cabinet, which surpassed all others, and which, in 1810, he generously deposited in Yale College. It has since been purchased for that Institution, and may truly be said to have been the radiating point of Geological and Mineralogical science in this country. The establishment indeed of professorships of the Natural Sciences in Bowdoin and Yale Colleges and in Harvard University, and the formation of a Botanical Garden near the nobly endowed Institution last named, have contributed greatly to improve the public taste and promote the progress of discovery.

The American Philosophical Society, formed at Philadelphia in 1769, under the influence of Franklin, but not chartered until 1780, may be considered as the parent of all similar societies in the United States. The American Academy of Arts and Sciences at Boston, was incorporated in 1780, and the Connecticut Academy of Arts and Sciences at New Haven, in 1799. Various other societies, with more limited objects, some for Horticulture and Botany, and others for Natural History in general, have followed this example.

Private collections of plants, and minerals, and shells, and insects, and birds, are every where becoming more numerous. Several of our Legislatures have made appropriations for the Geological, Botanical and Zoological survey of their respective states. And our General Government, though from its nature, it cannot be the direct and active promoter of science and learning, has, notwithstanding, contributed to this great purpose, by the exploring parties which have been sent out into our new and distant territories.* What an immense field does our country present for scientific research, extending as it does through more than twenty degrees of latitude, and embracing from the Atlantic to the Pacific Ocean, an area of more than two millions of square miles! When to this we add the English and Mexican dominions, with the various republics of South America, where, for causes which need not now be enumerated, only partial and very imperfect examinations have been made, the view of what yet remains to be done, in this Western Continent alone, is overwhelming to our imagination. Even in the investigations hitherto made, it is mortifying to national pride to see how much has been done by foreigners, and how little by native Americans. Yet we have among us distinguished naturalists, who want nothing but encourage-

* Every lover of science must rejoice that the General Government, availing itself of the powers necessary for the protection of Commerce, has decided to send an exploring expedition to the Southern Pacific.

ment to go forward with ardour in these pursuits, and who can and will furnish to the world the valuable products of their industry, if the publication of them, which, to be useful, must be costly, does not fall upon themselves, but is shared by the patrons and lovers of science.

What individual exertion cannot do, the combined strength of societies like ours may accomplish. Here, then, Gentlemen, is one of the great motives which has led to our union; and I now proceed to exhibit other motives, that our fellow citizens may see how deserving they are of public patronage and co-operation.

Our first object must be to place in our library every important work which has hitherto been published, in every part of the world, on the various branches of Natural History; and to make provision for the regular reception of all works to be published hereafter, and especially the periodical journals of science, by which our knowledge will be raised continually to the level of all modern experiments and discoveries. For this purpose, it is important that we should have, not only the various Floras, and Silvas, and Faunas, which have been and are daily published, but also books of travels into every region of the globe, whenever the natural productions of the country form an object of special attention to the traveller. Even bare catalogues are useful to direct our researches, and define the object of our labours.

But as books alone cannot make a naturalist, another and a principal object must be to form a cabinet of Natural History. This will, of course, include collections of minerals, and of fossil organic remains. With regard to such as have been or may be discovered in our own country, it will be our duty to search for and preserve them, to classify them according to their relative position and depth from the earth's surface, and accurately to record all that can

be known respecting them, as materials for a philosophic theory of the earth.

Our cabinet will properly include a Hortus Siccus, or collection of dried plants; and this is more especially important with regard to such as cannot be reared, or brought to perfection, in our own climate.

We wish to collect from every part of the globe, and arrange in proper order, from the lowest Zoophyte up to Man himself, all the varieties of animal existence. By minute and patient attention, all are capable of being so arranged as to convey even to the uneducated and transient observer, a degree of information of which he himself could form no conception, 'till convinced by personal experience. We wish particularly to exhibit the varieties of the human species. It is a most interesting subject to compare these varieties; and this can be done only by descriptions and drawings, or by representations in coloured wax, or by the process of embalming, or by a collection of anatomical preparations. To these, we would add, the comparison of diseased anatomy, by a collection of parts of the human frame affected by the various disorders to which it is subject; and the comparison of phrenology, by a collection, as extensive as possible, of skulls or of casts taken from them. We also wish to form a series of comparative anatomy, by arranging, in physiological order, the different organs of all animated beings. Indeed, I know not why we may not say—of all organized beings; for it would doubtless be possible to arrange a series of microscopical objects, by which we could exhibit the comparative system of plants as well as animals. Be this as it may, however, comparative anatomy is an essential branch of Zoology; and no scientific division can be very permanent or useful, which is not founded upon internal structure as well as external characters.

Beside the formation of a cabinet, a special and most important object is, the formation of a Botanic Garden,

where every possible variety of plant, whether for use or ornament, should be collected. All esculent vegetables which can be imported and naturalized, should here find their place. Every variety of fruit or forest trees, which will endure the severity of our winter, or the heat of our summer should be cultivated. In a word, no effort or experiment should be spared, till we have fully tested the capacities of our soil and climate.

As far as our literary labours are concerned, our object will be, in every department of Natural History, to obtain knowledge ourselves, and communicate what we obtain to others. For this purpose it is made the duty of some one of our members, whenever a specimen is presented or an experiment made, to lay before the Society a written report on the subject, which is placed on file and recorded. Our especial province will be, to give a minute history of nature within our own immediate circle; and if any discovery should be made, which we may think worthy of being communicated to the public, it will be included in our printed transactions.

II.

I would fain hope, that much of what has now been mentioned, will appear, to this respected assembly, so obviously useful, that it would even seem like presumption, were I to enter upon any formal or lengthened proof of its importance. Still, it may be proper to make a few observations on the utility of the Natural Sciences, in order to show, that there is no class of men in society, to whom the encouragement of them should be a subject of indifference.

As every improvement in cultivation comes within our designs, I scarcely need observe, how much the formation of a Botanic Garden, and the introduction of all the varie-

ties of fruits and flowers, and esculent vegetables, which can be naturalized among us, will improve Horticulture, and increase the wealth, and comfort, and enjoyment of the landed proprietor. The artist and the manufacturer, are still more interested in those improvements, which furnish each with more perfect materials on which to exercise his ingenuity. The political economist will bear in mind, that to the older and wealthier nations of Europe, most of the great sources of their present prosperity were not indigenous, but have been the result of adventitious discoveries, of scientific investigation, and the enterprising exertions of a few individuals.* The vast trade of Madeira was occasioned by the transplantation of the grape to a soil where it was not previously known. The potatoe, now the chief support of millions, was formerly unknown in Europe. The peach-tree was originally brought from Persia. The sugar-cane and the bread-fruit were not originally natives of the West Indies. The silk worm, first brought from China to Persia, and thence introduced into the Greek Empire, is now the source of large revenues to France and Italy. Merino sheep, probably of Moorish origin, and guarded with jealous care as the peculiar treasure of Spain, were secretly brought into France by Daubenton, and into this country by Col. Humphreys. The Cashmeer Goat, brought from Thibet, at a great expense, by the late Mr. Ternaux, has introduced a new and most beautiful manufacture into France. It is a very singular fact, that, when this country was discovered, no domestic animals were found here. All have been introduced by Europeans; and the wild horses of Mexico, and the numerous herds of wild cattle in South America, have sprung from those brought over by the Spaniards.

But of all the natural sciences, Mineralogy, perhaps, has wrought the greatest change within the shortest space of time. The impulse, communicated to the youth of our Col-

*See Note P.

leges by the splendid cabinet of Col. Gibbs, the lectures of Professor Silliman, and the labours of Cleaveland and Maclure, has extended itself through our country. Within the last twenty-five years, what treasures have been discovered! Quarries of slate and marble—mines of the useful and precious metals—inexhaustible formations of Anthracite and Bituminous coals—all are developing, with astonishing rapidity, the immense resources of our country. Our gold mines alone, are now found to be richer than those of South America or Russia. Who, then, that loves the prosperity of his country, will not feel the importance of promoting the purposes for which we are associated!

To those who are engaged in the education of youth, let me quote the striking remarks of Cuvier on the influence of such studies in forming habits of mental discipline. "The habit naturally acquired," says that great man, "in the study of Natural History, of the mental classification of a great number of ideas, is one of the advantages of that science that is seldom observed, and which, when it shall have been generally introduced into the system of common education, will become perhaps the principal one. By it, the student is exercised in that part of logic which is termed method, just as he is by geometry in that of syllogism; because Natural History is the science which requires the most precise methods, as geometry is that which demands the most rigorous reasoning. Now this art of method, once well acquired, may be applied with infinite advantage to studies the most foreign to Natural History. Every discussion which supposes a classification of facts, every research which demands a distribution of matters, is performed according to the same laws; and he who had cultivated this science merely for amusement, is surprised at the facilities it affords him in disentangling and arranging all kinds of affairs."

Finally, let me address you as Christians, and ask, What occupation can produce nobler views of the Divine Nature

and Providence, than the contemplation of His Works? The pages of inspiration tell us, that the invisible things of God, namely his eternal power and godhead, have been clearly seen, since the creation of the world,* being understood by the things that are made. It has been objected, I know, that many, who have been warmly engaged in pursuits like ours, have, while surrounded by the wonders of creation, been unmindful of the great Creator. That such has been the fact, though to an extent far less than the objection assumes, we are not disposed to deny. We object, however, to the inference which some have thence drawn. We attribute this result, rather to the influence of a little knowledge on the corrupt heart of man, than to the extension of knowledge. We believe, that "the knowledge which puffeth up" is eminently superficial; and in examining the progress of all sciences, we find, that proud presumption may accompany incipient discovery, but that more perfect investigations are invariably followed by profound humility. Alphonso, of Castille, when the light of Astronomical Science first dawned, through his instrumentality, on the darkness of his age, could exclaim, that if he had been admitted to the counsels of the Creator, he would have arranged the Universe better. He saw, that the movement of the heavenly bodies could not be reconciled with what was then supposed to be the planetary system; and, instead of doubting the correctness of his own knowledge, he dared to question the wisdom of the Almighty. How different on the mind of Newton was the effect of his sublime discoveries! With what awe, do we behold that profound intellect, covering its face with its own wings, like the burning Seraphim, before the throne of God!† As the occasion of man's fall, was an irregular desire of knowledge; so is it a part of that wisdom by which the Almighty seeks to lead us back to our Paradise, and to his presence, to surround us with wonders which

* Rom. i. 20.

† See Note Q.

give us constant and inexhaustible subjects of inquiry, and, at the same time, humble us by the perception of how little we can know without his aid.

It is thus, Gentlemen, with the science of Natural History. The farther we advance in knowledge, the better do we perceive how much we do not know, and this perception must forever abase the most profound Naturalist. "The minute philosophers," to borrow an epithet of the great Berkley, "may think, for a time, that their boasted discoveries are irreconcileable with revelation. They may raise the sand-hills of their systems, and think from them to demolish the fortress of the divine word.—Vain and impotent the attempt! Some fortunate discovery, as science advances, demolishes the whole by a single roll of its mighty waters, and the next wave washes it into eternal oblivion. Let us not fear, then, that Revelation can ever be seriously assailed, or injured, by Philosophy. It may sometimes be wounded in the house of its friends, by too great a degree of sensitiveness, which may prompt them to embrace untenable theories, and distort the language of the Bible, to make it accord with what they consider as the result of experiment."*

If, then our objects are important, on account of their utility to all classes of society, let me add, that the present is the most suitable time for the commencement of our labours. There is no room for delay; for while we speak, changes are going on which may deprive us of favourable opportunities. The hardy sons of New England, and especially of Connecticut, have long been among the foremost in settling our immense Western territories. The tide of emigration is rolling onward with astonishing rapidity, and innumerable tribes of reptiles and insects are retreating before it, as from an overwhelming enemy. It is desirable, that we should seize upon nature as it is, before the progress of civilization shall have subdued the wilderness. We cannot expect from new settlers, that they should attend to any thing beyond the provision for their own necessities. But we may take advantage of the opening given to the Naturalist, and hasten onward to accumulate, before it is too late, that information which cannot hereafter be obtained.

* See Note R.

III.

I pass on to consider in the third and last place,

The means by which our objects are to be accomplished.

And here we may be met in the threshhold by a startling objection. "Your plan," it may be said, "is too vast and varied to be practicable." To this, I reply, that the concentration of effort is, in our state of society, essential to success; and hence, that the very multiplicity of our objects is well fitted to create a more extensive and general interest. All that we aim at has been accomplished by others; why, then, may it not be accomplished by us? Patience and perseverance will attain to great purposes. And even if we are incapable of completing the whole, we at least may lay a foundation on which others may build, and, if we ourselves enjoy but little of the benefit, may entitle ourselves to the thanks of posterity. I cannot believe, however, that, when we have considered the means by which our plan is to be accomplished, there can be a dissentient voice as to the expediency of our attempt.

Every American traveller, must have been struck with admiration, in surveying, the immense collections, in every branch of Natural History, in the Royal Garden of Plants at Paris;* and he must have come to the conclusion, that

* See Note S.

the evident superiority of the French Nation in the Natural Sciences, is the result of the opportunities for acquiring knowledge, which are offered, in the French Capital, with a most generous and philanthropic profusion. No where else can he find such treasures, opened, without money and without price, to the humblest votary of science. It must have interested him, to pass from kingdom to kingdom, and see how this lofty example is imitated, though humbly, throughout Europe. The Zoological and Anatomical collections at Leyden, and the Anatomical representations in wax of the Gabinetto Fisico of Florence, must, in their turn, have attracted his attention: and I think that every lover of his country, must have felt the desire stirring within him of seeing such collections, and such means of knowledge, in his own land.

But there are various difficulties on this subject, arising from local and political causes.

The French collection, was commenced under an absolute monarch, at a time when France had Colonies in various parts of the world, and, from rivalry with England, was extending her marine, with the design of disputing the dominion of the ocean, as well as that of the land. The concentration of power and object, gave a rapidity to such accumulations, which we should seek for in vain, nay more, which is incompatible with the very nature of our institutions.

It was so in Holland; for, though a republic, she was essentially aristocratic, and her resources were under the influence of the house of Orange, and the powerful patrician families, from whom the members of the States General were selected. She was a commercial, and a colonizing nation, with a formidable fleet, and a jealous spirit of monopoly. She had one University, the pride of the Republic, renowned over Europe, and resorted to by scholars of every nation, on account of the celebrity of its medical professors. Here she could concentrate all the scientific treasures accumulated from age to age.

In Tuscany, there has been, for three centuries, an absolute monarchy; and where the will of the prince constitutes the law, a single individual, as was the case with Pietro-Leopoldo, with ample resources, and fond of the arts and sciences, can do more, though at the head of a small territory, than even a great nation such as ours can effect, where so many wills are to be consulted, and where the vast extent of country renders numerous collections necessary. Italy is also the country of the fine arts; where it was easier, of course, to make sculpture and painting tributary to physical science, in the exact resemblances of nature.

Yet even in the countries I have named, it is surprising to see with what small pecuniary resources, these collections were made, and how much they depended upon the untiring industry of a few naturalists. What would the French Cabinet have been without Daubenton? Yet for many years he received a salary of less than one hundred dollars per annum. What would the Gabinetto Fisico have been without Fontana?

We, of course, in our character, and habits, and institutions, resemble most the nation from whom principally we have sprung. But there are varieties of social position operating in England, which cannot exist here. The Royal Society is a National Society. Ours must, of necessity, be as numerous as our State sovereignties. In England, there are great Universities, and one great Capital, where the treasures of science may be concentrated.* In our country, Colleges must, of necessity, be spread far and wide, and the diversities of religious belief, dissipate and weaken their resources. There, the General Government of the Nation, legislate upon intellectual improvements, make grants for scientific purposes, encourage the labours of individual collectors, and, by appropriations, pay for what they have done, in bounties or by purchase.

* See Note T.

Here, the jealous watchfulness of State Sovereignties, claims this prerogative as an unconceded right. Yet, even in England, the great collections are due, in the first instance, to public spirited and opulent individuals; such as Sloane, the two Hunters, Dr. Mead, Sir James Edward Smith, Sir Joseph Banks, and others who might be enumerated, or to Societies like ours, formed for the encouragement of specific objects. Are we, then, as a nation, incapable of arriving at the same results? Let us consider exactly our own position, and see of what we are capable.

We boast, and I for one am not disposed as yet to allow that we boast in vain, of exhibiting to the world the grand experiment, such as the world had never before seen, of a people governing themselves. We govern, and are governed, in a manner wholly inexplicable to the theorists of the Old World. Not a soldier is to be seen in the wide extent of this immense republic, excepting on our frontiers. We govern, and are governed, by the will of the majority. Order is preserved, because it is the instinct of self-preservation; and every man knows, or ought to know, that his life, and liberty, and property, is, bound up in the life, and liberty, and property, of the community.

In Europe, the interest of the whole is made subservient to the interest of individuals. In America, that of individuals is subservient to the good of the community. The interest of society, is oftentimes sacrificed in Europe, to promote the interest of the individual; the interest of the individual, on the contrary, may be, and often is, sacrificed in America, to promote the interest of the public.

No doubt these are evils; and they are the evils of opposite systems. In this chequered state of being, where good and evil are the web and woof of the moral texture, the mixture cannot be avoided. It would be out of place for me to say, which system has the most evil or the most good; but let us take our system as it is, and

ask, Whether it excludes scientific improvement? I answer, No. The monarchist of Europe asserts it, but we are not disheartened by the assertion. Our mighty experiment of self-government, is far from being exhausted. We have not, it is true, the energy of despotic power which can command schools and colleges to spring into existence, and can at once turn the stream of a nation's resources to the formation of cabinets of science, or the fine arts. But we have a nation, every individual of which feels, that he is bounded only by the extent of those powers which God has given him; and the very basis of our institutions is, that every member of the republic is under a moral tie, that through him it should receive no detriment. We cannot, by a decree, transport from distant lands, the granite rock, to serve as a pedestal for the statue of an Emperor, but we can, by the subscription of a dollar through the millions of our nation, erect a prouder monument to the memory of our Washington.

To this power, then, we appeal, in behalf of Natural Science; and we ask our fellow citizens, to aid us in the establishment and maintenance of an institution, the object of which is, to promote the common good, by affording to all the means and opportunities of knowledge.

In our state of society, Union is eminently strength; but, as it would be vain to talk of colours to one who was born and continues blind, so, will it be impossible to produce that union by which society may be exalted and refined, unless we extend the boundaries of intelligence. To dwell on the importance of diffusing a more perfect system of education, might seem foreign from the present purpose; yet, I may be permitted to quote the farewell advice of him who was first in the hearts of his countrymen, as a maxim of political and moral wisdom. "Promote, as an object of primary importance, institutions for the general diffusion of knowledge. In proportion as the

structure of a government gives force to public opinion, it should be enlightened."*

I hope, gentlemen, that the day may come, when, by private munificence, our public institutions shall be so well endowed, as to render all instruction gratuitous; when the means of acquiring knowledge shall be as common and as free as the air we breathe; when the poorest member of our community, may feel that he has an undivided share in the privileges which ennoble his nature; and when, by the equalizing power of Christian charity, "he that hath gathered much shall have nothing over, and he that hath gathered little shall have no lack."

Our first mean of support, must be the contributions and donations of our resident members; and for this purpose, it should be considered as an honour and a duty for every lover of science to seek an admission into our Society, or, at least, to contribute towards our purposes. There are many who may be unable to give in money, and yet may have books, or specimens of some branch of Natural History, to place in our collection. One may have shells, another, insects or reptiles, a third, birds or quadrupeds, a fourth, dried or living plants, a fifth, fossils and minerals. In this way, with but little effort, and still less expense, specimens will be accumulated, the duplicates of which, may be advantageously exchanged with other collections.†

The love of completing a series, is a principle of Human Nature; and when that series is completed, the thought of its being again scattered, is painful in direct proportion to the difficulty with which it has been formed. In this manner, large private collections, at the death of their possessors, have been bequeathed to the public, or have been sold, in order to keep them together, at an immense discount from the sum they cost. In one, or both of these ways, may we reasonably hope for the augmentation of our cabinet.

*Washington's Farewell Address.

† See Note U.

The establishment of similar societies in other parts of the United States, will be viewed by us with great interest, and will be aided with the most cordial co-operation. Each will be the centre of its own circle, and from the infinite variety of nature, will have its peculiar advantages in the system of scientific barter.

The missionaries, sent by the various religious denominations, either into our own territories, or into foreign countries, are, in general, educated men, and may do much to promote the cause of Natural Science, without any interruption to the duties of their profession. The example of the Roman Catholic missionaries, is before our eyes; and the value of their labours in the cause of science, is universally admitted. *Little is known of China*, but what has been furnished by them. The French Jesuits, especially, have added greatly to the store of Natural knowledge; yet no one can accuse them of neglecting their official duties.* Why, then, may not our missionaries, as a useful relaxation from their arduous labours, furnish us with collections, and with much curious information, respecting the Natural History of the country in which they sojourn?

The Consuls of the United States, in various foreign ports, if appointed corresponding members, will, doubtless, consider it as a duty and a pleasure to aid our exertions. If they cannot themselves become Naturalists, they will serve, at least, as a medium of communication with scientific foreigners, and transmit to them, and to us, whatever we or they may have to communicate.

The captains and supercargoes of our merchant ships, are too intelligent and enterprising to refuse, what to them will be a small, but to us a most important service, that of accumulating specimens.

And, as for the officers of our Navy, I am much mistaken, if they do not enter with an ardent and generous zeal into our plan. No class of men in our country, have

* See Note V.

greater opportunities of knowing our wants, or our capabilities,—of contrasting our advantages or disadvantages with those of foreign nations—of appreciating the value of scientific improvements—of acquiring, in a word, that extended insight into men and things, which enables them to see clearly and pursue steadily, whatever contributes to the good of their country. No men have it in their power to study Natural History, with more success. There are none to whom it would be a greater solace, or a source of purer pleasure. Let us, then, frankly invite them to our aid, and enrol them on the list of our members.

The Navy will open another advantage, which no doubt would be willingly accorded by her commanders, or by the General Government. It will be remembered, that Linnæus obtained situations for his pupils in the ships of his own, or of foreign powers,—as chaplains, if they were in orders,—or as surgeons, if they were medical men,—or as travelling naturalists, if they embraced no other profession. There are, doubtless, young men in our Colleges of zeal and intelligence, who would like nothing better, than to be sent out on a three years' cruise as travelling naturalists. If this cannot be done, at the expense of our National or State sovereignties, several societies might combine, to raise a few hundred dollars per annum, for the maintenance of such a person. The materials, he could bring back, would more than repay all such exertions.

Need I mention our Ministers at Foreign Courts, or gentlemen of science and information, who may be travelling abroad! To such, our country is already indebted for many acquisitions, which will long survive them, and embalm their memories.

I have reserved, for the last, what will perhaps be one of the most prolific sources of gain: I mean our Foreign Correspondence. That there are many in Europe, who are eager to form a correspondence with Americans, in the hope of exchanging the productions of the Old World

for those of the New, I can bear personal testimony. In Italy, several distinguished men spoke to me with ardour, and even with anxiety, on this subject. At Turin, the distinguished Ornithologist, Bonelli, told me that he could furnish us with all the European birds, enumerated by Temminck, if we would send him an equal number of American birds. Bonelli, alas! is no more; but he has left pupils who are following in his steps, and who, no doubt, would be glad to revive his offer. Dr. Grottanelli, of Siena, offered to furnish us with minerals and plants on the same conditions. The younger Bartelone, of Bologna, would, I have no doubt, undertake the same pledge with regard to insects. In this manner, we may, by our own labours, and by this scientific commerce, gradually form a collection, the influence of which, on the future character of our community, may be more extensive than we have now capacity to calculate. It is only during the feeble period of infancy, that such institutions require to be fostered with peculiar care. That period past, their existence can hardly be called precarious.

Permit me, in conclusion, to observe, that we wish our Society to be considered eminently as a Christian Society. We have adopted as our motto, FROM NATURE UP TO NATURE'S GOD. We may, therefore, in humble confidence, hope for that blessing, without which, all human endeavours are vain.

I have thus, fellow citizens, performed, in a very imperfect manner, I am sensible, the office, with which the Society have entrusted me, of making known to you our plans and our wishes. Imperfect as it has been, I have been obliged to occupy more of your time than I could have wished; and I am grateful for the patient and uninterrupted attention you have paid me.

If I have been so fortunate, as to impress on your minds, the convictions of my own, you will not have failed to perceive that our objects are those which have always accompanied the growth of civilization and refinement in the Old World; that their utility has been so obvious as to have commanded the attention of the most enlightened political economists of the age; that they have been hitherto less patronized in the United States, because, from the comparative infancy of all our establishments, the vast extent of our territories, the continual migrations of society, the subjugation of the wilderness, and the perpetual enlargement of our borders, it was impossible to pay much attention to them, excepting in our older and wealthier communities.

But the time has come, when our Nation ranks among the foremost in political power, and in the energies of collective industry. If we do not now go forward to prove to the world, that we are capable of those refinements, which complete the structure of human society, it must, to every enlightened lover of his country, be the occasion of shame and mourning.

Let us then, do what is in our power. Let it be seen that we are sensitive to all that can embellish human nature. Let our City be conspicuous for her science, and her literature, as she is already for her religion, her morals, her love of order, and her industry; so that when another Centennial celebration shall gladden the hearts of our children's children, they may point with exultation to the monuments of our labours, and bless and venerate our memories.

NOTES.

Note A. p. 6.

Though the restoration of Botany, as a science is generally attributed to Otto, or Otho Brunfels, of Strasburg, who died in 1534, yet the first Botanic Gardens, were established in Italy. The oldest in Europe, was connected with the University of Padua, and was laid out in 1533; the second, with that of Pisa in 1544; the third, with that of Pavia, in 1556; and the fourth, which was also the most considerable, with that of Bologna in 1568.

In Holland, the most celebrated gardens were those of Amsterdam and Leyden, the latter of which was laid out in 1577.

In England, the Royal Garden at Hampton Court and the Garden of Medicinal Plants at Chelsea, had been richly stocked as early as the reign of Elizabeth. That of the University of Oxford, was founded in 1632, by Henry, Earl of Danby. The catalogue of it, was first published in 1648, by James Bobart, a physician and Botanist, born at Brunswick, who was its first superintendent.

Towards the end of the 16th century, the first Botanical Garden in France, was laid out at Montpelier, where there is a famous Medical College. Most of these gardens are still in a flourishing condition, and we may trace to their influence, many of those illustrious Botanists, by whom the science has been cultivated and adorned.

The Royal Garden of Plants, at Paris, was founded by Gui de la Brosse, physician to Louis XIII. Wishing to facilitate the study of Botany, he gave the king the ground it occupies; and by his unwearied solicitations, he prevailed on Cardinal Richelieu, to furnish means to defray its expenses.

The edict of the king for its establishment, dates as far back as 1626, and De la Brosse was named the first Intendant. It was not actually laid out, however, till 1635. A description and plan of the garden, with a catalogue of plants, which De la Brosse had collected there, was first published in 1636. The superintendence of this garden, was connected with the office of first physician to the king; but, in this dependent and subsidiary condition, it was greatly neglected, and its funds were appropriated to other objects. In 1732, this superintendence was separated from the office to which it had been attached; and the garden, becoming thus an independent and primary object of attention, was soon rendered the finest in Europe.

Note B. p. 7.

If this praise be exaggerated, we are to remember that it proceeds from a foreigner, and one whose name is also immortal. A more sober, and perhaps a juster estimate was made by Dr. Priestly: "The first English philosopher within this period" (between Descartes and Newton,) "was Mr. Boyle; and his is a name that must be mentioned with honour, in the history of almost every branch of experimental philosophy." He was as eminent for his religion as for his philosophy; a Christian in principle and practice, and a consummate Theologian. Advancing beyond his age, he set the example, not only of zeal in the cause of Missions, but also in that of translating the Scriptures, and circulating them among the heathen. He founded a lecture for the defence of revealed religion, which has been the occasion of some of the most admirable treatises on the evidences of our faith, which are to be found in any language. We may, therefore, safely acquiesce in the judgment of his biographer, that, "considered as a man, as a philosopher, and as a Christian, he came as near perfection as the defects of human nature would allow."

Note C. p. 9.

Their object was, in the language of their historian, Bishop Sprat, "to make faithful records of all the works of nature or art, which can come within their reach; that so the present age and posterity, may be able to put a mark upon the errors, which have been strengthened by long prescription; to restore the truths that have lain neglected; to push on those which are already known to more various uses; and to make the way more passable to what remains unrevealed."—"They have studied to make the knowledge of nature, not only an enterprize of one season, or of some lucky opportunity, but a business of time; a steady, a lasting, a popular, an uninterrupted

work. They have attempted to free it from the artifices and humours and passions of sects; to render it an instrument, whereby mankind may obtain a dominion over things, and not only over one another's judgments; and lastly, they have begun to establish these reformations in Philosophy, not so much by any solemnity of laws or ostentation of ceremonies, as by solid practice and examples; not by a glorious pomp of words, but by the silent, effectual, and unanswerable arguments of real productions." *Sprat's Hist. of the R. S. p.* 58, *as cited by the Biog. Brit. art. Boyle, ed. Kippis. vol.* 2. *p.* 500, *Note K.*

Note D. p. 10.

As it seems to be very generally admitted, that Millington made this important discovery about the year 1676, I know not that there is any reason to contest his claim. It is very remarkable, however, that with such a claim, he should have been so little noticed by English Biographical writers. Wood merely states, that he succeeded Dr. Willis, in 1675, in the Sedley professorship of Natural Philosophy, at Oxford, and that he was knighted in 1679. Athen. Oxon. vol. ii. p. 803. It is equally remarkable that Leibnitz, twenty-five years afterwards, should have been ignorant of this fact, and should have attributed the discovery to *Camerarius*. In a letter to Gackenholtz, dated Hanover, April 23, 1701, he speaks as follows, on this subject: "Novam etiam et magni inprimis momenti futuram comparationem plantarum suppeditabunt novæ (si porrò stabiliantur) observationes de duplicis sexus imitamento in plantis, de quibus agere maximè cœpit egregius ex naturæ curiosis Vir *Rudolphus Jacobus Camerarius*, et prosequi instituit nuper Dn. *D. Burcardus* juvenis in his studiis cum laude versatus, qui eruditam super ea re ad me epistolam scripsit. Nam in polline subtilissimo florum quærunt masculi seminis analogiam negantque, hujusmodi aliquid in ulla planta desiderari, etsi non semper nudo oculo perspiciatur: Adesse excipiendo pollini capsulas ovario fœmineo comparandas: A capsula exire stylum vel analogum aliquid, tamquam uteri vaginam: Cujus ad summitatem ex flore per solis calorem aperto, concutientis venti ministerio, sed transferat adplicetque pollen: Ex pollinis autem granulis spirituosum aliquid perductum ad ovarium, ut sic dicam, vel siliquam penetrare, atque ova vel semina illic fœcundare: Magno vel hinc indicio ejus rei, quod sublato præmaturè polline generatio nulla sequatur." Leibnitii Opera Omnia. ed. Dutens. Genevæ, 1768. Tom ii. pars 2, p. 173, Sec. x.

NOTE F. p. 22.

Linnæus was much better received in Paris than in London. Sir Hans Sloane and Dillenius were old, and could not relish the changes introduced into the science by the Swedish Naturalist. The letter by which Boerhaave introduced Linnæus to Sir Hans Sloane, for which I am indebted to my friend Dr. Barratt, is so beautiful that I am tempted to introduce it here. "Linnæus qui has tibi dábit litteras, est unice dignus te videre, unice dignus a te videri. Qui vos videbit simul videbit hominum par cui simile vix dabit orbis." The following translation may give the sense, but cannot convey the exquisite beauty of the original:—Linnæus, who will present to you this letter, is alone worthy to see you, alone worthy to be seen by you. He who shall see you together, will see two men whose equal the world can scarcely furnish.

NOTE G. p. 23.

Dr. Barratt, informs me that "Professor Lindley, in his introduction to the Natural System," a work which I have not seen, "has, by incorporating the labours of all the most eminent botanists, extended these families to the number of 272."

NOTE H. p. 24.

Among these, may be mentioned Persoon and Fries on the Fungi of Europe, and the late lamented Rev. L. D. Von Schweinitz on those of North America; Agardh and Greville, on the Algæ; Acharius, and our own Halsey on the Lichens; Kaulfus, Greville and Dr. now Sir William Jackson Hooker on Ferns; the Duke of Bedford, Borrer, and Dr. Barratt of Middletown, Conn. on the Willows; Michaux on the North American Oaks; Dr. Torrey of New York, on the Cyperaceæ, &c. &c. &c.

NOTE I. p. 24.

Hedwig was born at Cronstadt, in 1730, and died in 1799, at Leipsic, where he was professor of Botany. The fine botanic garden of Pilnitz, in which so much care has been given to the culture of cryptogamous plants, was created, it is believed, under his influence, by the Elector Frederic Augustus. He may be considered as a model for microscopical observations; and he established upon a new basis, the Natural History of Cryptogamous plants, by shewing that what Linnæus had taken for Anthers, were in reality the Capsules of Mosses. The system which he had founded on numerous and striking analogies, was proved to demonstration on the 17th

of January, 1774, when, by means of his microscope, he saw an Anther of the Bryum Pulvinatum open, and emit the pollen. He convinced the most incredulous, by sowing seeds of several mosses and ferns, which he succeeded in raising, and of which he distinctly saw the cotyledons.

Gaertner was born in 1732, and died in 1791. He denied Hedwig's theory of Mosses, conceiving that the Capsules, with their seeds, were buds. In this he was mistaken, but in general, his experiments were conducted with great accuracy. He was principally occupied in the illustration of fruits and seeds; and on these subjects, his works are considered as fundamental and classical.

NOTE K. p. 24.

By a simple, but ingenious adaptation of the Camera Lucida to his microscope, he is enabled to delineate with precision the magnified appearance of any object, and thus perpetuate and extend that knowledge which would be otherwise confined and transitory. The circulation of the sap, in its downward as well as upward movement, has thus been made distinctly visible; and the cryptogamia, by means of this powerful instrument, are found to be subject to those general laws which the labours of former botanists had fully demonstrated. These interesting experiments are now in course of publication by the learned professor Savii of Pisa.

NOTE L. p. 32.

See the memoir of Cuvier, "Sur le Squelette presque entier d'un petit quadrupède du genre des SARIGUES trouvé dans la pierre à plâtre des environs de Paris," in the 3d volume of his "Ossemens fossiles." "This rich collection," observes the distinguished discoverer, "of the fragments and skeletons of the animals of a former world is doubtless a wonderful circumstance. It has been amassed by Nature in the quarries which environ our city, as if reserved by her for the researches and instruction of the present age. Each day we discover some new relic; each day adds to our astonishment, by demonstrating more and more, that nothing which then peopled this part of the globe, has been preserved on its present surface.—There is scarcely a block of gypsum in certain strata which does not contain bones. How many millions of these bones have been already destroyed since these quarries have been dug, and this gypsum has been employed in building! How many are, even now, destroyed by mere carelessness! How many, by their minuteness, escape the observation of the most attentive workmen! One may judge of this, by the fragment I am about to describe. The lin-

eaments there imprinted are so slight, that to detect them we must view them closely. Yet how precious are these lineaments! They are the impress of an animal of which we find no other traces; an animal, buried perhaps for thousands of ages, now reappearing, for the first time, to the eyes of the naturalist." He then proceeds, according to his method of induction, to show, in a very clear and satisfactory manner, that it can be no other than the American Opossum; after which he concludes as follows: "I will not dilate upon the geological consequences of this memoir. It is evident to all, who are even slightly conversant with the systems relative to the theory of the earth, that it overthrows nearly all of them, in what relates to fossil animals. Hitherto it has been thought, that our northern fossils, were only of Asiatic animals. It was admitted, that the animals of Asia had passed into America, and had been buried there; but it seemed that the American genera had issued from their own soil, and had never passed into the countries which now form the Old Continent. This is the second proof" (the Tapir was the first,) "which I have discovered to the contrary. And persuaded, as I am, of the futility of all these systems, I am happy, every time that one of them is destroyed by a well-established fact. The greatest service which can be rendered to science, is to clear the ground, before we proceed to build; to begin, by demolishing those fantastic structures by which its avenues are choked, and which deter from such occupations, those who have happily become habituated, in the exact sciences, to yield only to evidence, or at least to class propositions according to their degrees of probability. With this last precaution, there is scarcely any science which may not become almost geometrical. The chemists have lately proved this with regard to their science; and I hope the time is not far distant when the same may be said of anatomists." If an apology be required for this long note, I hope it may be found in the interest, which every American must feel, in a fact so eventful and extraordinary as that which has given rise to it.

Note M. p. 33.

It may, perhaps, be thought, that the name of the illustrious Bergman should not have been passed over, even in this short narrative of the progress of Crystallography. Bergman certainly discovered, that different crystals, of the same substance, could all be deduced, in their geometric relations, from one primitive form, by the apposition of similar molecules, according to fixed and calculable laws. But it is, I believe, admitted, that Haüy was ignorant of Bergman's experiments, when he made the same discovery. As Bergman, therefore, did not contribute to Haüy's success, and did not pursue the subject, the introduction of his name was unnecessary. He died in 1784, at the age of 49 years.

Note N. p. 35.

The nomenclature of Haüy, though adopted in France, has not been equally successful, I believe, in other parts of Europe, or in America. Yet, if the attachment to old names could be overcome, this nomenclature, as it seems to me, would have many advantages. Why may not Greek compounds be naturalized as well as German? Haüy, following the method of Linnæus in Botany, introduced into Mineralogy, instead of descriptive phrases, binary denominations, composed of a specific name, with an adjective indicating each variety, taken from, its form if regularly crystalline, or from its combination, if crystallized imperfectly, or confusedly.

Note O. p. 35.

I have omitted the name of Cadwallader Colden, only because he was not a native American. The correspondent of Linnæus, would otherwise have been entitled to the most honourable mention.

Note P. p. 41.

The Horse Chestnut, was conveyed to Europe from the north of Asia by Clusius, a botanist, in 1550. The Kidney bean was brought from the East Indies. The Potatoe was first described by Caspar Bauhin, in 1590. Rice was originally a native of the Torrid Zone. The Bread-Fruit was introduced into the West Indies, by Sir Joseph Banks. The Crown Imperial, was transported from Constantinople; the Nasturtium, from South America; the Geranium, from the coast of Caffraria. See Thomson's Lect. on Botany, pp. 26, 27, 64. For further particulars, see Gibbon's History, vol. i. chap. 2, p. 83—86, and vol. vii. chap. 40, p. 88—100. Lond. 8vo. 1821.

Note Q. p. 43.

How sublime is the thought, with which Newton closes his treatise on Optics! The whole Universe, all material things, from comets and planets down to the bodies of animals, the organs of sense and motion, and the instinct of brutes and insects—"can be the effect of nothing else than the wisdom and skill of a powerful everliving Agent, who, being in all places, is *more able by his will to move the bodies within his boundless, uniform sensorium, and thereby to form and reform the parts of the Universe, than we are by our will to move the parts of our own bodies.*"—So in his Princi-

pia: "Deum summum necessario existere in confesso est. Et eadem necessitate *semper* est et *ubique*. Unde etiam totus est sui similis, totus oculus, totus auris, totus cerebrum, totus brachium, totus vis sentiendi, intelligendi et agendi; sed more minime humano, more minime corporeo, more nobis prorsus incognito. Ut cæcus ideam non habet colorum, sic nos ideam non habemus modorum quibus Deus sapientissimus sentit et intelligit omnia. Corpore omni et figura corporea prorsus destituitur, ideoque videri non potest, nec audiri, nec tangi, nec sub specie rei alicujus corporea coli debet. Ideas habemus attributorum ejus, sed quid sit rei alicujus substantia minime cognoscimus." Lib. iii. De mundi systemate.

Note R. p. 44.

It is refreshing to see, that such a mind as that of Cuvier, in a country over which infidelity had swept like the pestilential wind of the desert, could be profoundly philosophical without losing the sense of its own weakness in the sight of God. Cuvier was a believer, and openly professed his belief. While he sought as a philosopher to pursue the researches of Natural Sciencce, and to establish results from experiment and observation, independently of the authority of Scripture, it would be vain to seek in his writings any evidence that his experiments or observations shook his faith. If, then, any fact which he has established, should seem in any wise inconsistent with the Scripture history, let us wait, and not draw conclusions, 'till some further accession of knowledge may enable us to see the difficulties removed, and thus convince us that they were formed solely by our own ignorance.

Note S. p. 45.

In Walsh's National Gazette, No. 2255, Philadelphia, 1835, the number of specimens in the Garden of Plants, is stated to be as follows:

Animal Kingdom, ...	152,000
Vegetable do., ...	365,000
Mineral do., ...	60,000

Note T. p. 47.

The British Museum, is now exceedingly rich in its Cabinets of Natural History. Beside the great collection of Sir Hans Sloane, it contains the Library of Natural History, the Manuscripts, Drawings, &c., and the rich Herbarium of the late Sir Joseph Banks. The Linnæan Society, of London, possesses the Library and Herbarium of Linnæus, bought of the widow of Sir J. E. Smith for £5000. The Herbarium of Pallas and that of Frederic Pursh, are also in London.

Note U. p. 50.

That the ladies may have their share in conducing to the public good, will be seen by the following anecdote. A stranger arrived in Geneva with a collection of beautiful drawings, made by himself, of foreign plants. These, he lent to the celebrated professor De Candolle, but, as he was obliged to leave the city, he lent them only for a single day. De Candolle exhibited these drawings at a public lecture, and lamented that Geneva must lose so precious a treasure. The ladies of Geneva, instantly offered their services to copy them; many hands made light work; and by their skill and industry they accomplished the whole within twenty-four hours, thus preserving for their city exact copies of the whole collection.

Note V. p. 51.

No better example can be given of the acuteness exhibited by the Jesuits in their scientific researches, than the manner in which the Panax Quinquefolium or Gin-seng was discovered in America. This plant, it is well known, is very highly esteemed for its medicinal virtues in China, and when prepared by clarification, is worth its weight in silver. As it is in their opinion a Panacea, Linnæus gave it the name of Panax. The Jesuits, having been employed by the Emperor to draw a map of Tartary from actual survey, arrived in July, 1709, at a village within ten or twelve miles of the kingdom of Corea, and near the mountains where the Gin-seng is found. Father Jartoux received four roots from a Tartar, and taking one of them at random, he made an accurate drawing of it, which he sent to his Superior in France, together with a map of the country where it grows, between N. Lat. 39° and 47°, and E. Long. from Peking 10° and 20°. He stated that it grows, not in vallies, nor in marshes, nor in the bottom of ravines, nor in very open places, but on the sides of mountains covered with thick forests, around rocks, on the borders of ravines, at the foot of trees, and in the midst of every variety of herbage. If the forest should be consumed by fire, this plant does not re-appear 'till three or four years afterwards, which proves that it is an enemy of heat. In fact, it conceals itself from the sun as much as possible. "All this," adds Father Jartoux, "makes me believe that *if it can be found in any other part of the world, it must be principally in Canada.*" In consequence of this suggestion, Father Lafiteau, a Jesuit missionary in Canada was directed to search for it, and with the assistance of the drawings and descriptions of Jartoux, and the aid of the natives, he actually found it. He published an account of his dis-

covery in 1718, and the American root became for a time, 'till the market was overstocked, an article of great commerce with China, and the source of much wealth. The word *Gin-seng*, Jartoux adds, signifies in Chinese, "the representation of a man;" for what reason he cannot tell. The Tartars call it *Orhota*, which means "*the first of plants.*" See the original letter in the Lettres Edifiantes et Curieuses, vol. xviii. p. 127, of the new edition, and in the old edition, Tom x. p. 159. See also Du Halde Hist. de la Chine, where it is copied word for word, vol. ii. p. 150, &c. A good abstract of the whole is to be found in Bigelow's Medical Botany, vol. ii. p. 82—96, and Barton's Medical Botany, vol. ii. p. 191—202. My attention was first directed to this fact by Dr. Barratt.